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ETHNOLOGY.—*Was the California condor known to the Blackfoot Indians?* CLAUDE E. SCHAEFFER, Museum of the Plains Indian, Browning, Mont. (Communicated by John C. Ewers.)

Elderly Blackfoot Indians, in recounting the faunal lore of a now vanished past, sometimes refer to an immense bird, which visited the eastern foothills and adjacent plains of the Montana-Alberta region. Nearly half a century has elapsed, at least, since it was last sighted in this region. As a result, few living Indians claim to have seen the great winged creature; most know it only through traditions handed down from previous generations. Agreement is general among modern Blackfoot, however, that it was an uncommon, if not rare, migrant to their territory. The species, despite the infrequency of its appearance, seems to have found a niche in native nomenclature, as well as mention in their ceremonial rites, folklore, and procurement practices. If we have evaluated correctly Blackfoot descriptions of its appearance and habits, the bird in question can scarcely be other than the California condor, *Gymnogyps californianus* (Shaw). Although apparently thus known to the Blackfoot of an earlier day, the condor, strangely enough, has eluded the sight (and gun) of all but one white observer in this area. Accordingly, the wanderings of this "greatest of all flying birds of the earth" so far north of its recognized range have largely gone unnoticed by modern ornithologists. It seems advisable, then, to record here existing information on the condor from Blackfoot oral chronicles, in the hope that a new paragraph may thereby be added to the wildlife annals of the northwestern Plains.

The possibility of the condor's movement northward into the northwestern margin of the Plains was first brought to the writer's attention in connection with a study of Blackfoot ornithology. As part of this inquiry, identification of various local bird species was established with Indian informants and their respective native names recorded (Schaeffer, 1950). After the terms for the golden eagle (*pítau*), bald eagle (*ksixkikíni*), and turkey vulture (*píkoki*) were collected, coverage of the largest Raptores was deemed complete. However, informants volunteered the term *omaχsapítau*, "big *pítau*," and proceeded to describe the bird's appearance and habits. A new term was thus unexpectedly added to the check list of Blackfoot avifauna. Inquiries were accordingly instituted among a number of the oldest Indians of the Browning region, and their knowledge of the topic was explored. My sources of information are largely Piegan, and the data obtained refer primarily to Montana. A few traditions of Blood provenience are localized in the Calgary-Edmonton section of Alberta. Native testimony is presented here essentially as it was secured from the Indians. Distortions of fact arising from what appear to be errors of observation or lapses of traditional continuity are indicated as such in the text.

As a background against which to assay Blackfoot testimony on the condor, ornithological data on that species' range and incidence to the north are summarized below. The condor, reduced in numbers[1] and

[1] According to information based upon research by Dr. Carl B. Koford and communicated (11/28/50) to me by Dr. Alden H. Miller, Museum of Vertebrate Zoology, University of California, the number of surviving wild specimens of the condor is estimated at about 60. I am also indebted to Dr. Miller for his reading of the first draft of the present paper and for pointing out certain discrepancies in the data insofar as reference to the condor is concerned.

distribution in recent times, is now confined to "California west of the Great Basin and desert regions, and northwestern Lower California." Casually or formerly, the same authority (A.O.U. Check-list, p. 62) adds, it was reported from southeastern California, Oregon, and Washington. It may now be nearly if not actually gone from its former range in Baja California. In Oregon the presence of the condor on the lower Columbia River is attested by observers from the time of Lewis and Clark (1805–06) down to that of David Douglas (1825–27). There, it came in summer and fall to feed upon the spawned-out salmon, which lined the banks of the stream. For the State of Washington, the range is given as "north irregularly (west of Cascades) to northern boundary" (Dawson and Bowles, vol. 2, p. 548). A specimen was recorded at Fort Vancouver in 1827 (Bent, p. 12, citing Fleming). In 1826 Douglas stated that it was a common species as far north as the 49th parallel (Macoun and Macoun, p. 239). In southwest British Columbia, the Macouns (p. 239) characterize the condor as "a rare visitant at the mouth of the Fraser River . . . apparently attracted by the dead salmon." In 1880 J. Fannin reported seeing two birds at Burrard Inlet, while Rhoads, in 1893, stated that condors were reported on Lulu Island as late as "three or four years ago" (Bent, p. 12).

The consensus of ornithologists in respect to the condor's status on the Pacific coast north of California would seem to represent it as an extralimital wanderer in the region, particularly after the first quarter of the last century. Even on the lower Columbia, Harris (p. 21) remarks, "there is no valid evidence that it was ever an abundant species," and by the time of Townsend's visit (1834–35) "it was already beginning to frequent this northern extremity of its range in fewer numbers." Similarly, Gabrielson and Jewett (pp. 180–181) conclude that the condor, "if ever common in this state [Oregon], seems to have become rare or almost extinct between Douglas' first visit [1825–27] and the time of the Pacific Railway Surveys" (1855–59). Farther north, Dawson and Bowles (2, p. 548) agree that "on the whole it appears improbable that the California condor was ever resident in Washington, certainly not within the memory of the white man, and that its northern appearances are to be regarded solely as the fishing excursions of a Southerner." Taverner (p. 115) regards the reported occurrences in southwestern British Columbia as having an uncertain basis.

Turning now to the eastern limits of the condor's range, Dawson and Bowles (vol. 2, p. 548) remark that it formerly extended to Arizona and Utah. Bent (p. 12), on the basis of cave remains, notes that the species occurred in Nevada and New Mexico. It is recorded also in cave deposits from the Chisos Mountains. Certain "dubious" records report the condor in 1877 from Fort Sanders, southeastern Wyoming, and from some point in the mountains of Colorado (Harris, p. 46). There are perhaps other references from this southeastern area which have escaped my attention.

Farther to the north and more pertinent to our study, J. Fannin (p. 89), on September 10, 1896, observed two fine specimens between Calgary, Alberta, and the Rocky Mountains. This represents the sole ornithological record of the condor's presence within the purview of the Blackfoot.[2] Fannin admits in his report that he was not aware "that this bird was found east of the Rocky Mountains, or so far north as the point above mentioned." Later writers, such as the Macouns (vol. 2, p. 239), are inclined to doubt this occurrence so far east, especially since no specimen was collected. Although accepting the same student's sight record in southwestern British Columbia, Bent (p. 12) omits reference to the Alberta

[2] In this connection an entry from the diary of David Douglas (Harris, pp. 19–20), written at Fort Vancouver in 1827, may be quoted: "Obtained the following information concerning this curious bird from Etienne Lucien, one of the hunters who has had ample opportunity of observng them. . . . During the summer they are seen in great numbers in the woody parts of the Columbia, from the ocean to *the mountains of Lewis and Clark's River*, from four hundred miles in the interior" (italics mine). The region referred to here presumably is the drainage basin of the upper Snake River in present day Idaho. Since the source of this information is "the waggish Canadian voyageur who imparted to Douglas fantastic and highly imaginative misinformation regarding the nidification of the condor," the reference is scarcely taken seriously by ornithologists.

observation. Harris (p. 54) comments that the latter "would have been less startling had it been reported from this region seventy-five years earlier." And thus the case stands from the ornithological viewpoint.

A brief ornithological description of the condor may be included here, as comparative data against which to check Blackfoot accounts of the *omaχsapítau*. "Length, 4 to 4½ feet; spread of wings, 9 to 11 feet. Wings, long folding beyond end of square tail; head and neck, bare; skin, smooth, yellow or yellowish-orange and red; plumage, sooty-blackish commencing over shoulders with a semi-ruff of linear feathers, those underneath of similar character but less closely defined; the feathers of upper parts with browner tips; wings and tail black; outer webs of greater wing-coverts and secondaries grayish; wing-coverts and outer secondaries edged with whitish; *under wing-coverts, pure white*; bill, dark brown changing gradually to dull reddish on cere; iris, deep red; feet, horn with a patch on knees" (Pearson, p. 54). Parenthetically, while literature assigns a maximum wing spread of 11 feet the largest definite records range from 9 feet 9 inches to 10 feet.

We may next turn to the data representative of Blackfoot oral sources. The *omaχsapítau* is believed by some Indian informants to have visited the Browning area as recently as the early 1900's. Two or three very large birds are said to have appeared on the plains in various parts of the reservation about the year 1908. George Bull Child, one of those who saw them at the time, described the birds as dark in color and about 4 feet high. Since they took flight when approached closer than several hundred yards, he was unable to distinguish other salient features. At the time, however, older Piegan identified the species by its native name and recalled that it had visited the region at an earlier period.

A different version of possibly this same occurrence was obtained from Louis Bear Child. He stated that about the period 1907–08 some Gros Ventre Indians of the Fort Belknap Reservation, wrote Piegan friends that a great bird had been sighted in their part of north-central Montana. The Gros Ventre, although aware that it was a migrant from the south, were concerned over the significance of the bird's appearance in their country. The Blackfoot watched for it that year, but so far as Bear Child was aware, no one saw it. The following year an earthquake is said to have shaken the Fort Belknap region, an event which Bear Child, and perhaps the Gros Ventre, were inclined to associate with the visit of the "big eagle."

The incident best known to contemporary Piegan involving the *omaχsapítau* is that related of the deceased Raven (Hairy Face). Raven, or as he is more commonly known among bilingual Blackfoot, Big Crow, was born on the Blood Reserve in Canada but reared on the Montana reservation. Accounts of his experience vary somewhat in detail, but the following version is one told by Richard Sanderville (age 82). Big Crow and his wife were returning from Old Agency to their home on Little Badger Creek. In a coulee near the latter place, Big Crow noticed a large object some distance off, which he at first believed was a cow. Upon approaching closer, however, he saw that it was an immense, dark-colored bird, with a feathered ruff and a bald head. The strange creature took wing and flew off to the mountains. Sanderville remarked that Big Crow was not familiar with the species or with its native name. Further, upon hearing of his experience later, several of his friends are said to have evinced incredulity. The year in which this occurrence took place, so far as Sanderville could date it, was 1897. Thereafter, in accordance with the Blackfoot year count, the year became known as "that in which Big Crow saw the *omaχsapítau*."

Another episode of this character was recalled by Sanderville. Mary Jane, daughter of the Piegan Red Paint, married a white man named Pfemster or Phemister. One summer she and her husband moved into the Chief Mountain district of what is now Glacier National Park to hunt and fish. While in camp one day they saw four very large birds. Two of them appeared to be immature, just learning to fly, while the others, believed to be the parent birds, soared overhead. The observers considered that the adult pair had nested (sic) on Chief Mountain that summer. From mem-

ory Sanderville placed the date of this occurrence in 1879. Mary Jane died in 1942 at the presumed age of 89.

Rides at the Door (age 87), one of the few surviving Piegan with a record in intertribal warfare, is said to have seen a "big eagle" while raiding for horses somewhere to the south. Handicapped by deafness, this aged warrior was unable to supply further details of his experience.

An incident related by Chewing Black Bones (age 83) also involved an encounter by a group of Piegan raiders with a "big eagle." The narrator's father, Brocky (Tail Feathers Coming Over a Hill), a prominent Piegan warrior, was a member of the party. Led by Heavy Runner, the warriors set out to steal horses from the Crow Indians. They had traveled as far as "Bear Creek," an unidentified stream located west of the present Crow Reservation in southeastern Montana. Heavy Runner, who was in the lead, looked up to see a very large bird flying directly before them. Its wingspread and length of tail, the raiders noted, exceeded those of the eagle. The sight was so unusual that Heavy Runner immediately accepted it as a portent bearing upon the success of their venture. Accordingly he warned his companions, saying, "I have never seen a bird of this kind. Now that it has appeared before us, I am afraid. It seems to be trying to head us off. The outcome of our raid is now in doubt. We had better turn back." Most of the party agreed, and they and Heavy Runner returned home. Of the six who continued on, five were killed by the enemy. Since Heavy Runner was killed in the Baker Massacre of 1870, the date of this raid may be set in the 1860's. Chewing Black Bones believed that the bird's appearance upon this occasion and others was prophetic of misfortune. In support of his contention, he cited the death of the five raiders and the extinction of the previously mentioned Big Crow's family line.

Dog Takes a Gun (age 85) was born on the Blood Reserve in Alberta but spent most of his life among the Montana Piegan. He recalls his parents' account of an *omaχsapítau* sighted near Calgary shortly before the time of his birth. The date is to be placed in the early 1860's. Again the great size of the bird was emphasized. While feeding, it was said to lean forward so far that its breast nearly touched the ground. A tailfeather, described as about 2 feet in length, was dropped by this particular bird in flight and picked up by native observers. My informant added that the wing of another "big eagle" killed in this region equaled, when fully extended, the distance from a man's shoulder across his chest to the fingertips of his opposite outstretched arm.[3]

The next incident involves an encounter with the *omaχsapítau* by an Indian eagle trapper, now deceased. It was the practice of the Blackfoot, as with other tribes of the Northern Plains, to secure the feathers used in their costumes and ceremonial equipment from the golden eagle taken in concealed traps. Briefly, the procedure involved digging a shallow pit upon some eminence, covering it with brush and grass, and placing a stuffed coyote skin on top as bait. As the eagle alighted to feed, the hunter concealed within the pit, seized both legs of the bird, drew it down towards him, and dispatched it. Some degree of hazard was involved in this activity, in that failure to hold the captive securely often resulted in infliction of painful wounds from its talons. The supernatural powers attributed to the eagle evoked a series of conciliatory rites on the part of the trapper preceding and following its seizure.

White Bear, a conjuror and eagle trapper,[4] was a Cree by birth but intermarried among and lived with the Blood tribe of Blackfoot most of his life. He was said to have been about 83 years old at the time of his death in 1905. About 1850 White Bear was taking eagles in the region south of Edmonton, when an *omaχsapítau* visited his trap.

[3] Dog Takes a Gun claims to have seen this wing in the possession of a curio dealer in Calgary some 10 years ago.

[4] White Bear is noteworthy because of another practice attributed to him by his grandson. To tie himself up in the Houdini trick preliminary to a conjuring performance, he employed the leather thong, which also served as his *ceremonial* pack line (See Speck, 1935, p. 203, for the *nimaban* or ceremonial game carrying string of the Naskapi). The multiple functions thus assigned to the pack line opens up an interesting topic of investigation. So far as I am aware, the ceremonial game carrying string has never been reported among the Plains Cree.

Looking through the brush screen, he saw an immense bird soaring high in the air. After circling several times, the bird descended to the ground near the pit. It was quite wary, and only after considerable hesitation did it approach the bait. By this time White Bear had observed its size and concluded that it would be too difficult to capture, except at the risk of injury to himself. Seizing the stick used to frighten off the bald eagle, he thrust it through the pit cover and frightened the intruder away. Later he described it as the largest bird he had ever seen. It was dark in color with brown-striped tailfeathers (sic). Its head and hooked beak were large and its legs coarsely scaled. This incident was narrated by the grandson of the trapper, Harry Under Mouse.

Traditional information from a more distant past was secured from Yellow Kidney (age 80), whose knowledge of the earlier life and customs of the Piegan is extensive. In this connection he described the appearance and habits of the *omaχsapitau* in some detail. He referred to the characteristics of immense size and dark color, the great wingspread, and the elongated tail. He drew attention to the white underparts of the wings (sic) and, in contrast to the bald and immature golden eagle, the dark spots in the tailfeathers (sic). He described the large, hooked beak as dark blue, shading to yellow at the base. The head plumage (sic) was characterized as brownish in color.

Yellow Kidney was aware that the "big eagle's" home range lay far to the south and that it appeared infrequently in summer as far north as Montana and Alberta. Long ago he had been told by elderly Piegans that the great birds were attracted to this northern country by the remains of bison slain by the Indians on the plains. Richard Sanderville, it should be noted, also recalled traditions of their being seen feeding upon bison carcasses. At other times the *omaχsapitau* were sighted high in the air above the Blackfoot camps in the foothills. They would soar in wide circles and suddenly dart off at great speed towards the mountains to the west. There, early in the evening, the great birds sought rest atop some precipitous cliff, "where they slept with their heads tucked beneath their wings."

Yellow Kidney believed that long ago the Blackfoot succeeded, upon rare occasions, in capturing the "big eagle." At that time the conciliatory practices and disposal rites ordinarily associated with the young golden eagle were transferred to the *omaχsapitau*. The former bird, with its predominantly white tailfeathers, was considered a prize catch by all native trappers and special ceremonial treatment was accorded its remains. The informant went on to say that occasionally the nest (sic) of the *omaχsapitau* was so situated that hunters were able to make their way to it. Then the fledglings were removed, reared in captivity, and killed at maturity for their feathers. Seven primaries were detached from one wing and put aside for ritual disposal. The remaining wing primaries, the outer tailfeathers, the claws, and the wing-bones—humeri or ulnae—were then utilized for decorative and other purposes. The best feathers were employed for headdresses, the claws drilled for necklaces, and the wing-bones worked into whistles.

The flight powers of the "big eagle" enabled it to mount far into the sky and thus approach more closely to the Sun, the great celestial being of Blackfoot worship. As a result, the bird was believed to acquire a degree of the Sun's sacred character. The golden eagle, the white bison, the mountain lion, and a number of other birds and animals, by virtue of this or other attributes, were considered endowed with the same solar power. Hence to justify taking the life of one of these sacred creatures, as well as to avert subsequent misfortune, the Blackfoot sacrificed, whole or in part, its flesh and skin to the Sun. Accordingly, the seven wing primaries of the *omaχsapitau* were affixed to the tanned hide of a bison calf. They were arranged so that the quills came together at a point, with the distal ends spaced equidistant about a semicircle.[5] The

[5] Offerings thus made to a supernatural being appear to represent an old practice in Northern Plains cultures. Some years ago Wissler (p. 106, fn. 1) observed on the Blackfoot reservation a group of such offerings near a stone shelter used in the vision quest. They consisted of "an old coat, a shirt tied to a stick, and a peculiar fan-shaped object of twigs distended by being bound to a hoop of the same material. On the projecting ends of the twigs were eagle feathers. . . . We were told that such fanlike objects were often used when making

robe thus adorned was placed on top of a sweatlodge built for the occasion. Four medicine bundle owners of advanced age were then invited to enter the lodge, and while sweating, they prayed to the Sun for good fortune in various activities of life. At the conclusion of the observance, a youth carried away the decorated robe and placed it on a hilltop as a gift to the Sun.[6]

Previously an episode was given that involved an unexpected and possibly unwelcome visit of the *omaχsapítau* to the eagle trap. According to Yellow Kidney, however, it was the practice of an earlier generation of Blackfoot to take the great bird occasionally by this method, despite its wariness and size. In this case the immediate purpose was procurement of spiritual rather than material benefits. The trapper, it was explained, vowed to the Sun that if permitted to capture a "big eagle," he would, in the native idiom, "place fine pemmican[7] in its mouth." It was now expected that the normally shy bird, perhaps directed by the Sun, would circle the trap in flight and descend to the bait. The suppliant would then grasp its legs, immediately thrust forward a wooden billet for its talons to embed themselves (sic), pull it into the pit, place his knee upon its back and dislocate its neck. No part of the dead bird would be taken for the trapper's use. Instead, he removed the skin and mounted it in a lifelike manner, placed a morsel of pemmican in its beak, and abandoned it upon a hill as an offering to the Sun. In return for his sacrifice, the trapper anticipated that the spirit of the dead bird would appear to him in a dream and offer its supernatural power. The visitant would then say, "My name is *omaχsapítau*. I am known over all the earth. I am glad that you have treated me so well and offered me to the Sun. I will help you in any way that you may desire." Again it should be pointed out that these rites were ordinarily associated with the young golden eagle.

In a dream revelation of this kind it was not unusual for the spiritual benefactor to bestow its name upon the human suppliant. The term *omaχsapítau* thus appears to have entered the Blackfoot system of individual names some generations ago. According to Yellow Kidney, a Piegan named Bird Flying High (*piksipoánsin*) was blessed in this way by the "big eagle." He belonged to a group of the Fat-roasters band, which intermarried among the Blood Indians and went to live with them in Canada. The great bird, it is stated, appeared to him in a dream and said, "I will give you my name. You will be called *omaχsapítau*. You will become chief of your band and live to a very old age." Bird Flying High thereupon adopted the name of Big Eagle, and the dream vision was consummated by his later rise to the position of band chief. Yellow Kidney claims that when he was a small child he saw Big Eagle, who was already advanced in age at that time. Hence the latter's dream experience may be placed some time in the period before 1850.

Big Eagle, following his dream experience, wore suspended from his hair two tail-feathers of the *omaχsapítau*, to which a medal was attached as a support. The former were a symbolical representation of his spiritual power from the "big eagle"; the latter, his power from the Sun. Yellow Kidney, in his early childhood, saw the supernatural token and recalled that the feathers surpassed those of the eagle in length. At times, our informant stated, Big Eagle would demonstrate his spiritual gifts through the use of his feather token. He would direct his friends, "Look up at the Sun. Do you see anything around it?" They would look and fail to see anything unusual. Then Big Eagle would begin the power song given him by the Sun, "When I come up to the top of the hill, I shall see all about me." As he sang, he motioned with one of the feathers as if marking out a spot above the Sun. A sun dog (parhelion) would thereupon appear beside it. In this way, according to Yellow Kidney, who witnessed the feat in his youth, Big Eagle could produce as many as four sun dogs about the Sun at one time.

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sun offerings." The Kutenai similarly attached a small gift to a wooden hoop made of a twig as an offering to one of their supernatural spirits.

[6] For an account of Blackfoot sweat lodge rites and the disposition of offerings, see Wissler, pp. 259–62.

[7] A choice item of Blackfoot diet made from the tenderloin and marrow fat of the bison, mixed with berries and, for ceremonial purposes such as the above, divided into small pieces.

Information regarding another Blackfoot, who more recently bore the name of Big Eagle, was given by Harry Under Mouse. The source of the latter's data was Small Eyes, a prominent native ritualist on the Gleichen Reserve, Alberta. This Big Eagle, it appears, was a member of the All-Short-People band of the Blackfoot proper. He married a Blood woman and lived for some years among the members of that tribe. Big Eagle fasted for power in the region northwest of Calgary. On the top of Devil's Head Mountain, he sacrificed a piece of his flesh to the Sun. On nearby Bald Butte he then offered up to the "big eagle," a Cree foeman, whom he had killed at the spirit bird's request. In return he received supernatural power for use in warfare from both spiritual beings. As a symbol of his aerial protector, Big Eagle carried a tailfeather of an *omaχsapítau*. Before starting out upon a raid, he would stick the feather upright in the ground by the ceremonial altar. The direction in which it fell during the night indicated the way he must travel to obtain horses from the enemy.[8]

The skill of the second Big Eagle as a raider was said to have depended, in part, upon his use of a root with soporific power. After rubbing some of it upon the feather token, he would chew a small piece and spit upon both his hands. Then, taking the feather, he would motion with it in a peculiar way and thereby cause an enemy sentry to fall into a deep sleep. By this means he is said to have stolen 200 horses from the Assiniboine and driven them safely home. Through his power to put the occupants of an enemy lodge asleep, Big Eagle is also credited with acquiring from adjacent tribes one or more pipe bundles, which were later passed down among the Blackfoot. On one occasion, it was narrated, he was surrounded by hostile Cree on the top of Devil's Head Mountain. Through use of his supernatural power Big Eagle rendered himself and his party invisible and safely passed through the enemy lines. When the Cree advanced to the summit, the only living thing seen there was a great, dark-colored bird, which flew away. Big Eagle is said to have died in 1925, advanced in years. His son, Steven Fox (Short Crow or Thunder Chief), who now resides on the Blood Reserve, is said to have borne the name of Big Eagle during his younger years. The feather token of the elder Big Eagle came into possession of Small Eyes, but its present whereabouts are now unknown.

Harry Under Mouse informs me that other tangible remains of the *omaχsapítau* survived as late as a decade ago among the Cree Indians of Hobbema, south of Edmonton. He had been told by a Cree from that place that the ceremonial regalia of a performer in the Grass Dance consisted of the stuffed body, wings, and tail of one of these birds. The regalia was designed to be tied to the dancer's back, so that the condor's head rose above that of the wearer, the body and spread tail hung downward nearly to the ground, and an extended wing was attached to each arm. During the dance the wearer imitated the flight and other actions of the "big eagle." The bird that supplied this skin was presumably killed in this area by the Cree at some period in the past.

Native testimony in respect to the "big eagle" may be concluded by reference to its place in Blackfoot folklore. It will scarcely come as a surprise to learn that the *omaχsapítau* has become identified with the mythical roc in a Blood version of that tale.[9] The protagonist of the legend, according to Harry Under Mouse, is the aforementioned White Bear, "who first learned what and where the *omaχsapítau* was." As a result of his encounter with the bird, White Bear is said to have borne for a time the name of

[8] On the basis of preliminary results of a study now in progress, the Blackfoot *iniskim* or buffalo stone was employed in an analogous manner to determine, at certain times, the direction in which to hunt buffalo and, at others, to predict the outcome of the hunt.

[9] The Roc legend is perhaps widespread in North America. I have made no effort to trace its distribution in the Plains or adjacent areas in connection with this study. It may be noted in passing that a generalized version of the Blackfoot tale was obtained in 1947 from the Upper Kutenai, of Elmo, Montana, who assign its origin to the Sarsi. Fisher (p. 253) refers to the myth of an eagle or mythical bird abductor among such Algonkian-speaking groups, as the Micmac, Passamaquoddy, Malecite, Montagnais-Naskapi, Cree, Ojibwa, Menomini, Gros Ventre, and Cheyenne. Future folklorists, who trace the distribution of the myth, may well consider the condor as a possible influence in its western diffusion.

Big Eagle. The tale, it may be pointed out, conforms, in general, to the Blackfoot pattern of an individual's experience in the power quest.

The Blood tribe was encamped in the vicinity of modern Edmonton. Food was scarce and parties of hunters scattered out in different directions to search for game. Upon their return at night, one member of a party would be missing. Men continued to disappear in this way for some time.

Finally a party of four went out a long way to hunt. Near the place called Devil's Head, they put up a brush shelter for several days' stay. That night they sang their supernatural power songs for good luck in the next day's hunt. The following morning the four men started out, each in a different direction. All agreed to meet at camp that night.

A light snow fell that day. One of the hunters killed a deer. He butchered it and tied the meat in a pack upon his back. Then he started back for camp, using his bow as a cane to support the load. Walking along with his head bowed, he suddenly saw the shadow of a great bird upon the snow. He felt the bird grasp at the meat on his back, and the next instant realized that he was rising in the air. Too frightened now to look down, he closed his eyes. After a brief period he felt solid ground beneath his feet and lay back with the pack still in place. He opened his eyes to see that he was in a large nest surrounded by the bones of deer, bison calves and even human beings. It came to him then that the last represented the remains of those hunters recently lost.

He sat up and looked around. The nest was located upon a high cliff, from which escape seemed impossible. Nearby was an immense bird, which cried in a strange way. The hunter realized this was the creature that had carried people away. He called upon the Sun for aid. Beside him were two young birds, scarcely able to fly. He began to pray to them for help. Untying his pack, the hunter threw bits of meat to them, which they ate. He continued doing this in order to bring them closer.

Finally, he pushed the whole chunk of meat over. The feeding birds were now within reach. He quickly grasped their legs in each of his hands. They began to flap their wings, nearly jerking him into the air. Still retaining his hold, he inched over to the edge of the cliff. Then he pushed the birds off into space, throwing himself off at the same instant. Again he closed his eyes. He found that the flight power of the birds, although insufficient to support his weight, served to check his descent to the ground. It seemed a long way down. Finally he landed in safety. Before releasing his rescuers, he detached the longest feather from the tail of each bird. Then he started to make his way home.

It was late in the evening when he arrived at camp. He recognized the cries of his wife and parents, who were mourning atop a nearby hill. As he listened, someone went over and led them back to their lodge. He looked inside the lodge and saw that his people had cut off their hair and gashed their arms and legs. Only then did he realize that they were mourning his death. Going inside, he greatly surprised the occupants. They could scarcely believe that he was alive, but he convinced them that he was not a ghost.

The hunter then asked his wife to invite the old men of the camp to his lodge. His mother began to prepare food for them. After all had eaten, he related his experience and as proof displayed the tail feathers of the young birds. As the old men examined the trophies, they noted that they were nearly the length of a grown person's arm. The hunter's companions, who had also returned by this time, told how they had followed his tracks to where they ended in the snow and picked up his bow nearby. In this way it became known what creatures had caused the people to disappear. As a result of this incident, the hunter later received supernatural power from the "big eagle."

Accounts from Blackfoot oral sources previously set forth in respect to the *omaxsapitau* and its place in the ethno-ornithology of that group may now be summarized. The identification of the *omaχsapitau* as the condor and the latter's occurrence in Blackfoot territory rests upon three types of traditional evidence: (1) a series of native sight records made over a period of half a century or more, (2) reflections of identity and presence in various aspects of Blackfoot culture, and (3) notions of modern Indians regarding the bird's size, habits, and appearance derived from (1) and (2). The second of these types of data has been adequately treated in the body of this study. Hence, it will suffice to summarize in some detail the remaining two.

As a rough measure of the validity of our

data, we may comment briefly here upon the degree of interest manifested by the Blackfoot in the avian world. In general, it may be said, wildfowl represented a segment of the local fauna and flora, which, together with the Blackfoot and their cultural structure, constituted a closely knit biotic community of the northwestern Plains. The place of the Blackfoot in such an ecological system may be epitomized by Speck's characterization (1921, p. 349) of the Algonkians of the northeastern forests, a comment that applies equally well to their linguistic congeners of the plains: "The native Indians live much closer to Nature than most white people could hope to do. Their knowledge of wildlife is therefore inexhaustable in quantity, though it is often far from being scientifically correct." The Blackfoot, dependent predominantly upon the bison for subsistence, were better mammalogists, perhaps, than ornithologists. Nevertheless, the group built up over generations an extensive body of knowledge based upon observation of the local avifauna, the influence of which pervaded such varied fields as hunting and trapping, material crafts and decorative arts, curing practices, folklore, and ceremonial rites, songs, and dances. As a result, most Blackfoot became acquainted from childhood with the appearance, habits and culturally defined attributes of the avian species within their ken. It is against this background of familiarity that native testimony on the *omaχsapitau* should be evaluated.

In respect to the physical features and habits of the *omaχsapitau*, nearly all Blackfoot traditions stressed the factors of great size and dark color. Other elements cited by one or more informants, include the naked head, the feather ruff, the dark, hooked beak, the length and power of the wings, the white area underwing, the extended tailfeathers, and the coarsely scaled legs. Reference was also made to the bird's wariness, its habit of soaring in great circles and suddenly darting off at great speed, and the inclined posture in feeding. Certain of these traits, such as the feathered ruff, bald head, great size, etc., are sufficiently distinctive of the condor to suggest identity.

In contrast to the preceding list of characteristic traits must be set others atypical of the condor. Such discrepancies in our data have been noted wherever recognized. Some, no doubt, represent errors introduced unconsciously into the flow of Blackfoot traditions. Others appear to be traits transferred by native observers from the golden eagle to the *omaχsapitau*. Nidification in the eastern foothills of the Rockies, undoubtedly, represents one such case. The predatorial habit assigned in the Blood legend to a scavenger species is another. It may be recalled that the Indians classified the *omaχsapitau*, both taxonomically and terminologically, with the golden eagle. Only one informant, Jim White Calf, seemed aware of the former's genetic relationship to the turkey vulture. The confusion evident in the minds of native ornithologists may have been the result of the condor's infrequent appearances in this area, in modern if not in earlier times. Few Blackfoot during the last century have ever seen the species at close hand or over a period of time. In view of this unfamiliarity, it is surprising that greater errors have not been introduced in native descriptions. Such, then, represents the traditional evidence upon which identifications of the condor must, at the moment, rest.

Turning next to the reported occurrences of the *omaχsapitau* in Blackfoot territory, we find that they are placed by native observers, both living and dead, at irregular intervals from the early 1900's back to the middle of the previous century. Of such appearances, the least credible, perhaps, is that of 1907–08, a date posterior to the final sight record (Rhoads) of the condor on the north Pacific coast[10] by more than a decade. Raven's reported observation of the *omaχsapitau* in 1897 comes within a year of Fannin's sight record near Calgary. Preceding these appearances is the Phemister occurrence of the 1870's; those of Takes a Gun's parents and Brocky's of the 1860's; and White Bear's of the 1850's. The testimony of Yellow Kidney in respect to the Indian named Big Eagle and to other topics, seems referable to a still earlier period. From these data, scanty and unsatisfactory

[10] Gabrielson and Jewett (p. 181) report, on the basis of what appears to them good authority, the presence of two or more condors in southern Oregon in 1903 and again in 1904.

as they are, it would seem that the condor appeared in the Montana-Alberta region prior to the 1850's sufficiently often to leave a definite impress upon Blackfoot institutions and thus give rise to the traditions related by Yellow Kidney. Such seasonal movement of the condor northward along the Continental Divide may, perhaps, parallel its observed wanderings (1805–34) up the west coast to the lower Columbia and the Fraser. In subsequent decades the species was seen less frequently in Montana and Alberta, as well as along the coast, until its terminal appearance in both regions just before the close of the century.

A final point already mentioned in our study calls for elaboration here. The historical sources indicate that the condor was attracted to the lower Columbia and lower Fraser Rivers by the multitude of dead, migrant salmon, which in autumn lined the banks of those streams. What comparable food resource, it may be asked, served to draw the species to the northwestern margin of the Plains? The black-tailed deer[11] immediately comes to mind, the range of which has been shown to closely overlap that of the condor (Elliott, p. 122). However, it seems more probable, as native traditions suggest, that the bird's major item of subsistence in this region lay in the readily accessible remains of bison killed by the Blackfoot and their neighbors. As Ewers (p. 358) has recently pointed out, the impounding of bison at drive sites was largely carried on by the Blackfoot late in fall and early in winter, a period which found the condor absent from the north. However, a plentiful supply of meat in this area was assured during the warmer months of the year. Then the hunt was also organized on a cooperative, group basis in the form of the surround on horseback, or at an earlier period, on foot. The abandonment by hunters of bison bones and offals at this season, which in fall supplied tallow and meat for the manufacture of pemmican, afforded a source of diet for the condor and other carnivorous creatures.

In conclusion, information gathered from Blackfoot traditionalists suggests, in the writer's opinion, the condor's former movement northward, as a casual and infrequent visitant, along the eastern slopes of the Rockies as far as Montana and Alberta. The evidence for this statement is scarcely of a nature as to win acceptance from modern ornithologists, whose standards of proof require something more tangible than sight records or native traditions. The present study, however, is designed to stimulate further investigation of the topic. Inquiries should be carried out among Canadian Blackfoot and adjacent Cree, from whom significant information, and, even more concrete evidence of the species' identity and presence may still be obtained. If such data are forthcoming, it will be possible to add, in the words of one student, "another section to the jigsaw puzzle of *Gymnogyps*' extra-limital wanderings." Until that time, memories of the "big eagle" will continue to be preserved among the descendants of those bison-hunting tribesmen, who long ago observed its great, sweeping flights from out of the fastnesses of the Rockies.

[11] One authority believes that the condor preferred deer meat to any other. He observes that "they can make hash of a dead deer, sheep or other small animals; yet it seems that they have not the power to cut through the skin of a horse, cow or other large animal until the meat is somewhat decomposed" (Elliott, pp. 123–24, quoting Pemberton).

BIBLIOGRAPHY

AMERICAN ORNITHOLOGISTS' UNION. *Check-list of North American birds*, ed. 4. 1931.

BENT, ARTHUR C. *Life histories of North American birds of prey, part 1*. U. S. Nat. Mus. Bull. 167. 1937.

DAWSON, WM. L., and BOWLES, JOHN H. *The birds of Washington*, 2 vols. Seattle, 1909.

ELLIOTT, CHARLES (ed.). *Fading trails: The story of endangered American wildlife*. New York, 1943.

EWERS, JOHN C. *The last bison drives of the Blackfoot Indians*. Journ. Washington Acad. Sci. **39:** 355–360. 1949.

FANNIN, J. *The California vulture in Alberta*. Auk **14:** 89. 1897.

FISHER, MARGARET W. *The mythology of the northern and northeastern Algonkians in reference to Algonkian mythology as a whole*. In "Man in Northeastern North America," Frederick Johnson (ed.). Pap. Robert S. Peabody Foundation for Arch. **3:** 226–262. 1946.

GABRIELSON, IRA N., and JEWETT, STANLEY G. *Birds of Oregon*. Corvallis, 1940.

HARRIS, HARRY. *The annals of* Gymnogyps *to 1900*. Condor **43:** 3–55. 1941.

MACOUN, JOHN and JAMES H. *Catalogue of Canadian birds.* Geological Survey of Canada, Ottawa, 1909.

PEARSON, GILBERT T. (ed.). *Birds of America.* Garden City, 1936.

SCHAEFFER, CLAUDE E. *Bird nomenclature and principles of avian taxonomy of the Blackfeet Indians.* Journ. Washington Acad. Sci. **40**: 37–46. 1950.

SPECK, FRANK G. *Bird-lore of the Northern Indians.* Public Lectures by Univ. of Pennsylvania Faculty, 1919–20, **7**: 349–380. 1921.

———. *Naskapi: The savage hunters of the Labrador Peninsula.* Norman, Okla., 1935.

TAVERNER, P. A. *Birds of Canada.* Dept. of Mines, Nat. Mus. Canada, Bull. 72, biol. ser. 19. Ottawa, 1934.

WISSLER, CLARK. *Ceremonial bundles of the Blackfoot Indians.* Amer. Mus. Nat. Hist. Anthrop. Pap. **7** (2). 1912.

PALEONTOLOGY.—*New Desmoinesian crinoids.* HARRELL L. STRIMPLE, Bartlesville, Okla. (Communicated by Alfred R. Loeblich, Jr.)

Glaukosocrinus, n. gen., is here proposed with *G. parvisculus* (Moore and Plummer), n. comb. as the genotype species. Description of *Aesiocrinus erectus*, n. sp., *Acrocrinus expansus*, n. sp., *Lecythiocrinus optimus*, n. sp., and *Schistocrinus ovalis*, n. sp., is given. All figured specimens are from exposures of the Oologah limestone formation, sometimes referred to the Altamont limestone of Kansas, Des Moines series, Pennsylvanian, located east of Tulsa, Okla.

Glaukosocrinus, n. gen.

Dorsal cup moderately low truncate, semiglobular with deep basal invagination. Columnar scar small, round, occupying the median portion of a relatively large IBB circlet. Five small IBB are restricted to basal concavity. Five moderately large BB form a part of the lateral calyx walls and flex strongly inward to form sides of the basal concavity. Five large RR have short articulating processes which are directed mildly outward. Outer surfaces of RR curve in to form adsutural slopes between articulating facets. Anal X is large, pentagonal and does not extend into the interbrachial region. RA is pentagonal and rests on r. post. and post. BB. It supports a small pentagonal RX, which extends only slightly into the interbrachial area.

Genotype.—*Malaiocrinus parvisculus* Moore and Plummer (1940).

Known range.—Des Moines series, Pennsylvanian; North America.

Discussion.—This form was referred to *Malaiocrinus* Wanner (1924) by Moore and Plummer (1940). It has certain characteristics superficially similar to that genus and may represent a trend of specialization leading to the genus but certain factors seem sufficient to warrant separation. *Malaiocrinus* has anal plates of normal structure in normal (primitive) arrangement. Anal X is hexagonal. In *Glaukosocrinus* the anal plate is pentagonal and does not extend above the normal cup height. The radial articulating facets of *Malaiocrinus* are long, directed strongly outward and the columnar scar is very large, almost entirely covering the IBB plates. *Glaukosocrinus* has short radial articulating facets directed only slightly outward and the columnar scar is small.

Glaukosocrinus parvisculus (Moore and Plummer), n. comb.

Figs. 13–16

This species has been adequately described. The specimen figured herein was collected by the author in the stone quarry some 7 miles east of Tulsa, Okla.

Genus **Aesiocrinus** Miller and Gurley, 1890
Aesiocrinus erectus, n. sp.

Figs. 9–12

Dorsal cup is broad, truncate bowl-shaped. Five IBB form a large pentagonal-shaped disk with slightly depressed median section. Five large BB curve into the subhorizontal basal area but also comprise a good portion of the lateral cup walls. Five large RR have arm articulating facets directed slightly outward and not entirely filling the distal faces of the plates. Outer ligament furrow is shallow but well defined. Ligament pit furrow is shallow and ligament pit is sharply impressed. Transverse ridges are sharply defined, narrow lateral furrows are backed by unusually long oblique ridges. Muscle scars are limited in area and are deeply impressed. Intermuscular notches and furrows are broad and short. The right shoulder of l. post. B is extended and has an extra facet for reception of an anal tube plate. R. post. R and the anal plate are

missing in the holotype but measurements leave no doubt as to the existence of only one anal plate in the posterior interradius, which plate was in broad contact with the post. B.

The entire surface of the dorsal cup is mildly granular in appearance. Depressions occur at the apices of RR and BB. Columnar scar is decidedly pentagonal in outline. Maximum width of dorsal cup is 18.5 mm, height 8.2 mm.

Remarks.—The general contour of the dorsal cup of *A. erectus* is very similar to that of several species of *Plummericrinus* Moore and Laudon (1943) and is quite unlike that of any other species of *Aesiocrinus*. Characteristics, other than general appearance, in common with *Plummericrinus* are the depressions at the angles of BB and RR and the extension of the outer surfaces of RR into the adsutural area between the arm articulating processes. However, *Plummericrinus* has three anal plates in the posterior interradius and a round stem.

Occurrence.—Stone quarry some 7 miles east of Tulsa, Okla.

Holotype.—Collected by the author. To be deposited in the U. S. National Museum.

Genus **Acrocrinus** Yandell, 1846
Acrocrinus expansus, n. sp.
Figs. 1, 17–20

Dorsal cup is of moderate height, wide at the base and mildly constricted at the distal extremity. Two BB of equal size are confined to a shallow basal concavity. The walls of the basal depression are composed of two circlets of small plates. Five RR are hexagonal and are adjoining except where interrupted by the large anal X in the posterior interradius. Articular facets are small, horse shoe shaped.

The BB and RR are separated by about six circlets of plates which are designated as intercalaries (ii). In the first circlet below the RR and anal X series, there are 12 hexagonal ii^1, 14 ii^2, 16 ii^3, and 14 ii^4. Exact placement of succeeding series is difficult owing to slight irregularities and the incipient nature of those nearest the BB. Plates of the posterior interray continue unbroken to the BB disk and also in the anterior ray. In other rays the series are broken. Considering the large number of plates the arrangement is remarkably symmetrical.

The columnar scar is very small and round. Arms and tegmen have not been observed. Cup plates are devoid of ornamentation. Greatest width of dorsal cup (basal) is 11.0 mm, width at distal extremity is 6.5 mm, height 9.0 mm.

Remarks.—*Acrocrinus wortheni* Wachsmuth (1882), *Acrocrinus pumpkensis* Strimple (1949), *A. brentwoodensis* Moore and Plummer (1937), and *A. pirum* Moore and Plummer (1937) have calices similar to the present species in general outline. They have broad basal areas and tend toward constriction in the distal extremities of the cup. *A. pirum* is elongated and has a greater number of plates than other species. *A. wortheni* has fewer plates and a different arrangement of intercalaries than found in *A. expansus*. *A. pumpkensis* has a limited number of intercalaries and the cup does not constrict so noticeably at the

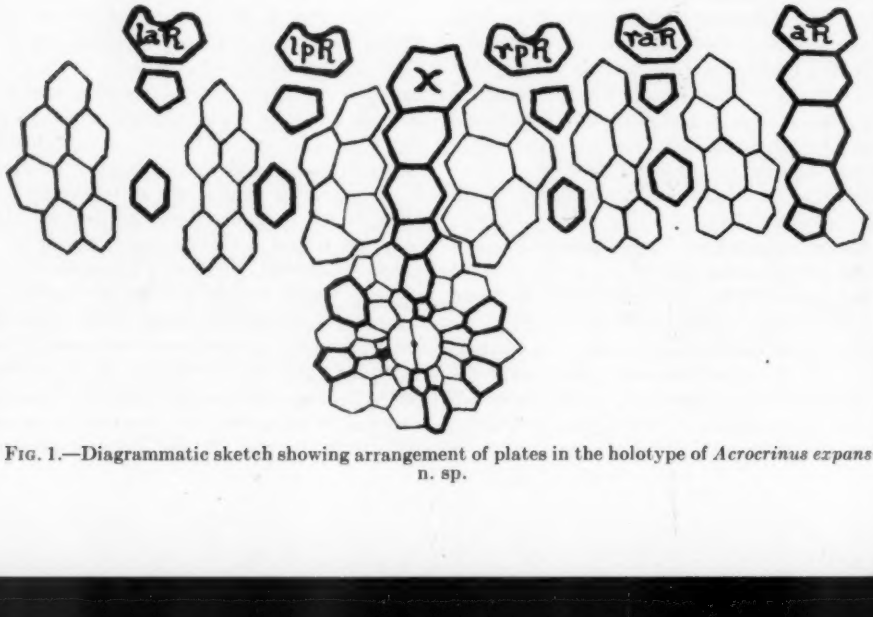
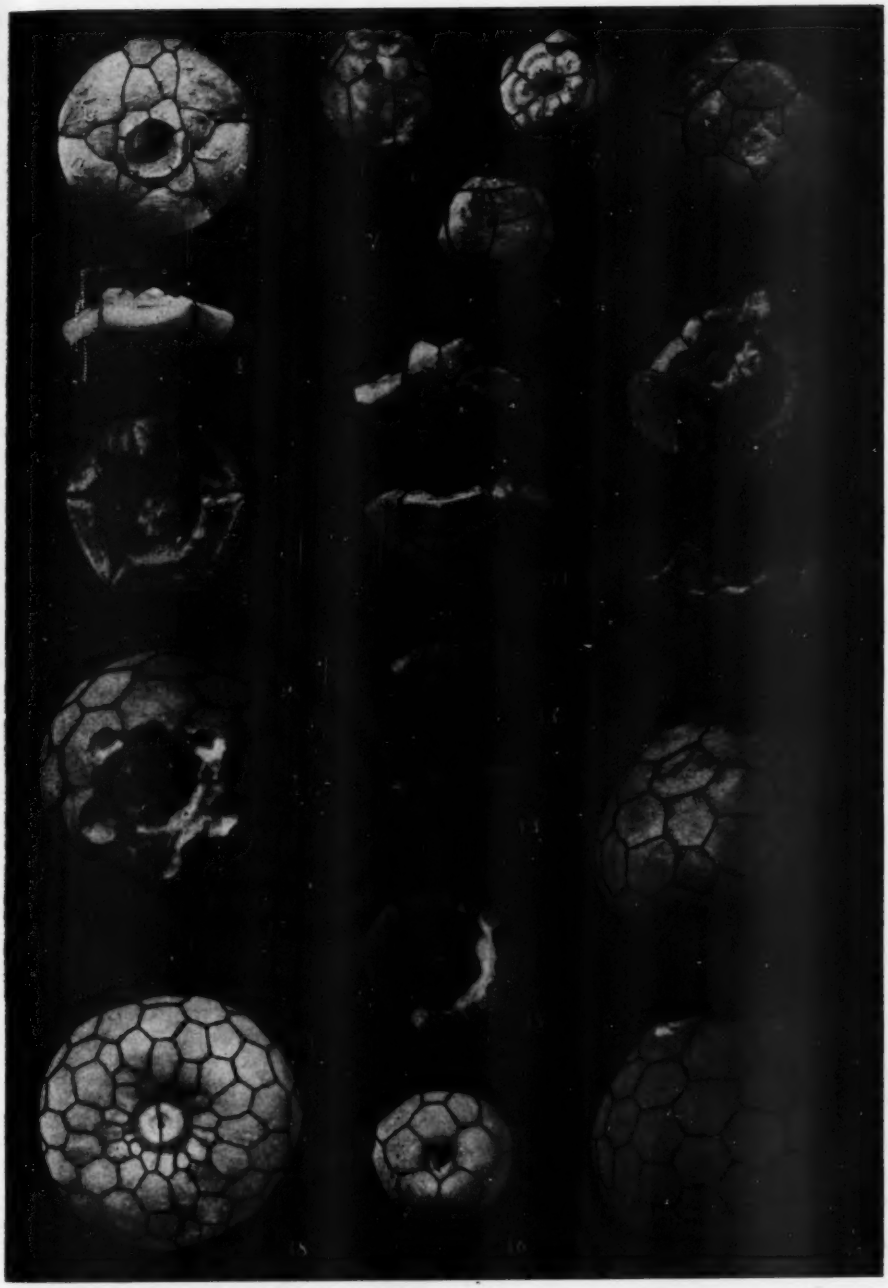


FIG. 1.—Diagrammatic sketch showing arrangement of plates in the holotype of *Acrocrinus expansus*, n. sp.



FIGS. 2–5.—Holotype of *Schistocrinus ovalis*, n. sp., from below, anterior, summit, and posterior, × 1.8. FIGS. 6–8.—Holotype of *Lecythiocrinus optimus*, n. sp., from posterior, summit, and base, × 1.8. FIGS. 9–12.—Holotype of *Aesiocrinus erectus*, n. sp., from base, summit, anterior, and posterior, × 1.6. FIGS. 13–16.—Typical representative of *Glaukosocrinus parvisculus* (Moore and Plummer), n. comb., from anterior, posterior, summit, and base, × 1.8. FIGS. 17–20.—Holotype of *Acrocrinus expansus*, n. sp., from summit, base, anterior, and posterior, × 3.5.

distal extremity. In *A. brentwoodensis* all RR are in contact with four plates in addition to lateral contact with adjoining RR, whereas in *A. expansus* only the two posterior RR have contact with four plates and the three anterior RR are each in contact with three plates.

The only other described Pennsylvanian species is *A. elegans* Strimple (1949) which has a slender, elongated cup.

Occurrence.—Stone quarry about 7 miles east of Tulsa, Okla.

Holotype.—Collected by Melba Strimple. To be deposited in the U. S. National Museum.

Genus **Lecythiocrinus** White, 1880

Lecythiocrinus optimus, n. sp.

Figs. 6–8

Dorsal cup is elongated, more or less spherical in outline. Three unequal IBB form a mildly upflared, broad base. The smaller IB is right posterior. Five BB are long, hexagonal plates with proximal portions curved to join IBB plates. Five RR are small pentagonal plates with prominent, wide arm articulating facets. There is a pronounced reduction in width of RR as the upper edge of the cup is approached. An oval shaped opening is in the upper extremity of post. B and lower lateral portions of l. post. and r. post. RR. When the cup is viewed from above or below there is a mildly pentagonal outline due to slightly raised median areas in the proximal portions of BB.

Columnar scar is small, round. Arms and tegmen are unknown. The greatest width of dorsal cup is 10.4 mm, height 10.6 mm.

Remarks.—*L. optimus* differs from other described species in having broad, rather distended articulating processes. The outline of the cup is somewhat comparable to those of *L. adamsi* Worthen (1883) and *L. olliculaeformis* White (1880).

Occurrence.—Road cut on eastward extension of thirty-first Street, southeast of Tulsa, Okla.

Holotype.—Collected by Frank Crane. To be deposited in the U. S. National Museum.

Genus **Schistocrinus** Moore and Plummer, 1940

Schistocrinus ovalis, n. sp.

Figs. 2–5

Dorsal cup is shallow, bowl-shaped. In the median portion of a broad, shallow basal concavity there is a sharply impressed, small, round columnar scar. Five IBB form a cog shaped disk surrounding the impressed area. Five small BB are more or less triangular shaped plates with the exception of post. B which is rather elongate and is truncated for reception of anal X. Five large RR are in solid contact with the IBB plates and prevent lateral contact between BB. Three anal plates are in normal (primitive) arrangement. RA is a narrow, elongate plate supporting the narrow proximal face of RX above and is in contact with anal X to the left. RX expands noticeably as it enters the interbrachial region. Anal X is a large, long plate.

All cup plates are unornamented. Arms and tegmen are unknown. The dorsal cup has a width of 16.6 mm, height of 3.5 mm.

Remarks.—*S. ovalis* is more comparable with *S. torquatus* Moore and Plummer (1940), the genotype species, than with other described forms. *S. torquatus* has more prominent IBB plates, the impressed basal area is entirely occupied by the columnar scar, BB have more angular proximal facets and the plates of the posterior interradius are more advanced in arrangement.

Occurrence.—Stone quarry about 7 miles east of Tulsa, Okla.

Holotype.—Collected by the author. To be deposited in the U. S. National Museum.

REFERENCES

MILLER, S. A., and GURLEY, W. F. E. Journ. Cincinnati Soc Nat. Hist. **13:** 14. 1890.

MOORE, R. C., and LAUDON, L. R. Geol. Soc. Amer. Spec. Pap. 46: 56, 58. 1943.

——— and PLUMMER, F. B. Bull. Denison Univ., Journ. Sci. Labs., **32:** 218–244, pl. 12, figs. 1–3. 1937.

————. Univ. Texas Publ. 3945: 98–101, pl. 14, fig. 6; pp. 217–222, pl. 2, fig. 6. 1940.

STRIMPLE, H. L. Amer. Journ. Sci. **247:** 900–904, pl. 1, figs. 1–6, 1949.

WACHSMUTH, C. Illinois State Mus. Nat. Hist. Bull. 1: 41. 1882.

WANNER, J. Perm. Krin. Timor, 2e Nederl. Exped.: 177–183. 1924.

WHITE, C. A. Proc. U. S. Nat. Mus. **2:** 256, pl. 1, figs. 4–5. 1880.

WORTHEN, A. H. Illinois State Mus. Bull. 1: 37. 1883.

YANDELL, L. P. Amer. Journ. Sci., ser. 2, **20:** 135–137. 1846.

PALEONTOLOGY.—*Brachiopod homonyms.* G. ARTHUR COOPER, U. S. National Museum, and HELEN M. MUIR-WOOD, British Museum (Natural History).

While preparing a list of the brachiopod genera for the forthcoming "Treatise on Paleontology," the authors found a number of homonyms, which are adjusted below. In addition to these, three names previously thought to be homonyms proved to have been incorrectly replaced. Substitutions for these erroneously displaced names are also included herein.

Argentiproductus nom. nov. for *Thomasella* Paul, 1942, Zentralbl. Min. Geol. Paläont., Abt. B, **6:** 191 (non Fredericks, 1928, Bull. Com. Géol. Leningrad **46** (7): 778, 789, Brachiopoda).

Type species: *Producta margaritacea* Phillips, 1836.

Callispirina nom. nov. for *Mansuyella* Reed, 1944, Palaeont. Indica (n. s.) **23,** mem. 2: 505 (non Endo, 1937, Bull. Manchurian Sci. Mus. 1: 353, Trilobita).

Type species: *Spiriferina ornata* Waagen, 1887.

Capillirostra nom. nov. for *Rhynchonellopsis* Böse, 1894, Palaeontogr. **41:** 57, 77, 78, footnote (non Vincent, 1893, Ann. Soc. Malac. Belge **28,** mém.: 51, Brachiopoda).

Type species: *Rhynchonellina? finkelsteini* Bose, 1894.

Elinoria nom. nov. for *Elina* Fredericks, 1924, Bull. Com. Géol. Petrograd **38** (3): 320, 321 (non Blanchard, 1852, in Gray, Hist. Chile **7:** 28, Lepidoptera; or Ferrari, 1878, Ann. Mus. Stor. Nat. Genova **12:** 84, Hemiptera; or Houlbert, 1918, in Oberthuer, Étude Lép. **15:** 325, Lepidoptera).

Type species: *Spirifer rectangulus* Kutorga, 1844.

Equirostra nom. nov. for *Isorhynchus* King, 1850, Mon. Permian Foss., Palaeont. Soc.: 81, 112 (non Schoenherr, 1833, Gen. et Sp. Curc. **1** (1): 22; 1836, **3** (2): 631, Coleoptera).

Type species: *Terebratulites aequirostris* Schlotheim, as represented by DeVerneuil in Geologie de la Russie d'Europe **2,** pl. 3, fig. 1. 1845.

Hirsutella nom. nov. for *Hirsutina* Kirchner, 1934, Neues Jahrb. Geol. Paläont. **71,** Abt. B (1): 106 (non Tutt, 1909, Brit. Butterfl. **3:** 154, Lepidoptera).

Type species: *Spirifer hirsutus* Alberti, 1864.

Labriproductus nom. nov. for *Worthenella* Girty, 1938, Journ. Washington Acad. Sci. **28** (10): 442 (non Walcott, 1911, Smithsonian Misc. Coll. **57** (5): 125, Vermes).

Type species: *Productus wortheni* Hall, 1858.

Marionites nom. nov. for *Marionella* Bancroft, 1928, Mem. Manchester Lit. Phil. Soc. **72:** 181 (non Cobb, 1922, Journ. Washington Acad. Sci. **11:** 504, Vermes).

Type species: *Marionella typa* Bancroft, 1928.

Nudirostra nom. nov. for *Leiorhynchus* Hall, 1860, Ann. Rep. New York State Cab. Nat. Hist. **13:** 75 (non *Liorhynchus* Rudolphi, 1801, Archiv Zool. [Wiedemann] **2** (1): 49, Vermes).

Type species: *Orthis quadricostata* Vanuxem, 1842.

Phymatothyris nom. nov. for *Pallasiella* Renz, 1932, Abh. Schweiz. Paläont. Ges. **52:** 40, 41 (non Sars, 1895, Crustacea Norway **1:** 505, Crustacea; or Kirby, 1910, Synon. Cat. Orthopt. **3:** 168, Orthoptera).

Type species: *Pallasiella kerkyraea* Renz, 1932.

Pirgulia nom. nov. for *Pirgula* DeGregorio, 1930, Ann. Géol. Paléont. Palermo **52:** 30 (non Tessmann, 1921, Mitt. Zool. Mus. Berlin **10:** 215, Lepidoptera).

Type species (by monotypy): *Lyttonia ?* (*Pirgula*) *pedicula* DeGregorio, 1930.

Plectorhynchella nom. nov. for *Monticola* Nalivkin, 1930. Mem. Com. Géol. Leningrad **180:** 86, 188 (non Boie, 1822, Isis [Oken] 1822: 552, Aves).

Type species: *Athyris collinensis* Frech, 1902.

Sphaerirhynchia nom. nov. for *Wilsonella* Nikiforova, 1937, Palaeont. U. S. S. R. Mon., Leningrad, **35:** 33 (non Carter, 1885, Ann. Mag. Nat. Hist. (5) **15:** 320, Spongiae).

Type species: *Terebratula wilsoni* J. Sowerby, 1816.

Striispirifer nom. nov. for *Schuchertia* Fredericks, 1926, Bull. Acad. Sci. U. R. S. S. **20** (5–6): 406 (non Gregory, 1899, Geol. Mag. (n. s.) dec. 4, **6:** 351, Echinodermata).

Type species: *Delthyris niagarensis* Conrad, 1842.

Sulcirostra nom. nov. for *Rhynchonellopsis* DeGregorio, 1930, Ann. Géol. Paléont. Palermo **55:** 6 (non Vincent, 1893, Ann. Soc. Malac. Belge **28,** mém.: 51, Brachiopoda).

Type species: *Rhynchonellina seguenzae* Gemmellaro, 1871.

Tunarites nom. nov. for *Tunaria* Hoek, 1912, Neues Jahrb. Min. Geol. Stuttgart, Beil. Bd. **34:** 247 (non Link, 1807, Beschr. Nat. Samml. Univ. Rostock **3:** 165, Coelenterata).

Type species. *Tunaria cochambina* Hoek, 1912.

SUBSTITUTIONS FOR EXISTING NAMES

Aetheia Thomson, 1915, Geol. Mag. **2:** 389 (non *Aethia* Merrem, 1788, Vers. Grundr. Gesch. Vögel I, Tent. Nat. Syst. Av.: 7, 13, 20, Aves; and Huebner, 1825, Verz. bekannt. Schmett.: 340, Lepidoptera.). Substitute *Thomsonica* Cossmann, 1920, Rev. Crit. Paléozool. **24:** 137.

Type species: *Terebratula gualteri* Morris, 1850.

Megerlia King, 1850, Mon. Permian Foss., Palaeont. Soc.: 81, 145, not preoccupied by *Megerlea* Robineau-Desvoidy, 1830, Mem. Prés Acad. Roy. Sci. Inst. France **2:** 266, Diptera. *Mühlfeldtia* Bayle, 1880, Journ. Conch. **28:** 240, proposed for *Megerlia* King, 1850, is a synonym.

Type species: *Anomia truncata* Gmelin, 1767.

Yakovlevia Fredericks, 1925, Rec. Geol. Com. Russian Far East **40:** 7 (non *Jakowleffia* Puton, 1875, Petites Nouvelles Ent. **1** (128): 512, Hemiptera). Substitute *Muirwoodia* Licharew, 1947, C. R. Acad. Sci. Moscow (n. s.) **57** (2): 187.

Type species: *Productus mammatus* Keyserling, 1846.

PALEONTOLOGY—*Substitution for the preoccupied brachiopod name* Hystricina.

MERRILL A. STAINBROOK, Brandon, Iowa. (Communicated by G. A. Cooper.)

Dr. G. Arthur Cooper has recently informed me that Dr. Helen Muir-Wood and he have discovered that the name *Hystricina*, proposed by me in 1945 for a genus of atrypoid brachiopods, is preoccupied by *Hystricina* Malloch, 1932 (Rec. Canterbury [N. Z.] Mus. **3:** 433). To replace it I am suggesting **Spinatrypa** (*Hystricina* Stainbrook, not *Hystricina* Malloch, 1932). The type species is *Atrypa hystrix* var. *occidentalis* Hall.

BOTANY.—*A contribution to the lichen flora of Alaska.*

GEORGE A. LLANO, Arctic, Desert, Tropic Information Center, Maxwell Air Force Base, Alabama. (Communicated by John A. Stevenson.)

The following new species, varieties, forms, new names, and distributions have been taken from a manuscript prepared as a report[1] of field work carried out in Alaska by the author in the summer of 1949 and by P. F. Scholander in 1948. The final report will contain a record of all macrolichens collected in Alaska including the Aleutians. All *Stereocaula* and Cladoniaceae were determined, respectively, by Dr. I. M. Lamb and Dr. A. W. Evans.

1. **Stereocaulon glareosum** (Sav.) H. Magn. in Göteborgs Kgl. Vet. och Vitterh.-Saml. Handl. **30:** 60. 1926.

var. **brachyphylloides** M. Lamb, var. nov.

A specie typica differt phyllocladiis subpersistenter graniformibus aut subdigitato-concrescentibus, passim tantum papillae-formiter excrescentibus; cephalodia magna, conspicua, ut in forma typica.

Forming caespitose-pulvinate, low clumps with uneven surfaces. Podetia firmly attached to the soil, short and stout, up to 1.5 cm long and 1–2 mm thick, congested, irregularly branched, ± upright or various intricated, not dorsiventral; ± terete, clothed down to the base with a thin, smooth, adpressed, pale rosy-subochraceous tomentum; rigid but not markedly ligneous. Phyllocladia lateral on podetia, scanty in lower parts, congested and numerous in upper parts, cinereous-whitish, matt, unicolorous, mostly concrescent grainlike or concrescent-subdigitate,

[1] *Studies on the lichen flora of Alaska.* The North Slope of the Brooks Range, with Appendix. The work on which this report is based was supported by the Arctic Institute of North America with funds provided by the Office of Naval Research and was conducted under the auspices of the Smithsonian Institution.

small (0.1–0.2 mm ± diam.), only rarely and in a few places becoming ± distinctly elongate-papillate. Cephalodia abundant, conspicuous, laterally sessile on podetia, smoothly subglobose, well constricted at base, 0.4–1.5(–3.0) mm diam., pale roseate-brownish (± flesh colored), matt, the surface smoothly continuous or often rhagadiose-fissured; the larger ones (3 cm diam.) becoming irregularly pulvinate and dividing into several irregular convex portions. Reactions: phyllocladia KHO + greenish-yellow, Pd + (slowly) sulphur-yellow.

ALASKA: 151–152°W., 68°20′N., Anaktuvuk Pass, 1,000 m.s.m. on naked soil, coll. *G. A. Llano & Neil Weber 527* (no. 1161, Lamb, TYPE), sterile.

2. **St. paschale** (L.) Hoffm. Deutsch. Fl. 130. 1796.

var. **erectum** (Frey) M. Lamb, comb. nov.

Podetia developing in a compact or loose manner, erect to suberect, about 4 cm high, somewhat branched.

Anaktuvuk Pass, *Llano 402b*, in a dry aggraded stream floor, among mosses and *Peltigera*.

3. **Peltigera venosa** (L.) Baumg. Fl. Lipsiens. 581. 1790.

f. **tartarea** Llano, forma nov.

Superficies superior sordida, pruina pulverulenta vel squamosa tecta, inferior tomentosa, alba usque pallide bruneola, venis carentibus vel inconspicuis; sporae aciculares, 2–3 septatae, hyalinae, 36–40 × 4–6.6μ. A typo differt discrepatione superficierum durarum.[2]

Upper surface dull, covered with a powdery to scaly white pruina; lower surface tomentose, white to pale brownish without veins, or veins indistinct.

Lake Schraeder, 145°W., 69°20′N., on soil, P. F. Scholander, 1948.

4. **Parmelia birulae** Elenk. in Ann. Mycol. Berlin **4**(1): 36. 1906.

var. **grumosa** Llano, var. nov.

Thallus imbricatissimus, acervis valde arcuatis compositus, lobis latis e lobulis minoribus fimbriatus; cortex superior ceraceo-furfuraceus.

Thallus strongly imbricated in strongly arched heaps, lobes broad with sharp to rounded sinuses and fringed with smaller lobelets, upper cortex waxy-furfuraceous.

[2] Edith K. Cash, Plant Industry Station, Beltsville, Md., kindly provided all Latin descriptions except for *Sterocaulon*.

Anaktuvuk Pass, at the summits of lower mountains in protected depressions over mosses or other lichens. *Llano 236, 485d.*

5. **Cetraria scholanderii** Llano, sp. nov.

Thallus foliaceus, 10–15 cm in diam., lobato-crenatus, 4–6 mm latus, rugulosus, lobis valde imbricatis, ascendentibus, inflexis vel canaliculatis praeditus; cortex superior isidiis dense congregatis, simplicibus vel bifurcatis, albis obscurisve, verruciformibus vel vermiformibus ad apices obscuras tectus, pallide griseolus vel pallide griseo-vinaceus, interdum atro-strigosus vel marginibus olivaceis vel viridi-nigris, nitens; cortex inferior atro-piceus, deinde atro-brunneus vel interdum pallide brunneus in apicibus loborum, subnitidus, leniter venato-bullatus rugosusque, areis rhizinarum tenuium fibrosarum vel verrucis conspersis praeditus; cortex superior K+, intense viride-flavus, medulla K–, K(C)–, J–.

Apothecia raria, lateralia vel subterminalia, subpedicellata, 5–6 mm. lata; discus planus usque subconvexus, carneo-pallidus, glaber usque subrugulosus, margine albe, isidiis numerosis brevibus atro-apiculatis ornatus vel albo-crenulatus; asci saccato-clavati, 42.9 × 22μ, ad apices incrassati, octospori; paraphyses plus minusve distincti, septati, simplices, 1.43 × 38μ; sporae globoso-ellipsoideae, incolores, 9.9–11 (–13) × 3.3–5.7 (–6.6) μ; spermogonia non visa.

Thallus foliaceous, 10–15 cm in diam., lobate-crenate, 4–6 mm wide, rugulose, with strongly imbricated, ascending, inflexed or canaliculate lobes, upper cortex obscured by densely growing simple or bifurcate, white to dark, verruciform to vermiform isidia with darka pices, color light grayish, or light grayish-vinaceous with occasional streaks of black, with olive-green margins, or dull greenish black, shiny; lower cortex pitch-black becoming dark brown to pale shiny brown on occasional lobe tips, subshiny, weakly veined-bullate and wrinkled, with scattered patches of thin, stringy rhizinae, or warts; upper cortex K+ bright green-yellow, medulla K–, K(C)–, J (subsection *Glauscentes*).

Apothecia rare, terminal or marginal, subpedicellate, 5–6 mm wide, disk plane to subconvex, flesh-colored, smooth to slightly ridged, thalline margin white, with numerous short black-tipped isidia or white crenulate; asci 42.9 × 22μ, with thick hyaline apices, paraphyses more or less distinct, septate, simple, 1.43 × 38μ, spores 8 in ascus, globose to ellipsoid,

with distinct wall, 9.9–11 (–13) × 3.3–5.7 (6.6) μ.

This species differs from *C. chrysantha* by its grayish coloring and densely isidiate upper surface; it differs from *C. norvegica* in color as well as in the type of isidia. *C. norvegica* is described with isidia cylindrical to coralloidea-ramose developing from furrows or lobe margins; these are relatively fine, brown-tipped isidia. The isidia of *C. scholanderii* are coarse, robust, tipped with black, simple to bluntly bifurcate, densely growing over the thallus, not from furrows and less so on the margins of lobes. Named after Dr. Peter F. Scholander, who first brought it to my attention, in appreciation of his many collections from the Brooks Range. A ubiquitous species along the Brooks Range, around Anaktuvuk Pass growing on rocks, over mosses and other lichens, along talus slopes up to 3,000 feet (154, 323, 330, 341, 390, 406).

Type, Lake Schrader, July 20, 1948, P. F. Scholander and W. Flagg.

6. **Alectoria irvingii** Llano, sp. nov.

Thallus subcaespitosus, depressus, subrigidus; rami 8 (–10) cm longi, dichotome divisi, axilibus late-angularibus, ad apices attenuati, subfibrillosi, fibrillis ad axes rectos vel recurvos rectangulariter dispositis, ad bases robusti, 1–2 mm lati, torti, cortice interdum rimoso et aperto, in hemicycliis volventes, intertexti, sulcati, interdum foveolati, demum cylindricales vel angulares, subcompressi vel ad locum ramorum plani, deinde cylindricales, nitidi, olivaceo-brunnei vel in partibus umbratis pallidiores, vel atro-brunnei, ramis vetustioribus et basibus subnigrescentibus; apothecia, spermogonia, soredia, et pseudocyphellae carentes.

Thallus subcaespitose, depressed, subrigid, branches 8(10) cm long, dichotomously branched, with wide-angling axils, apically attenuate, subfibrillose, with fibrils at right angles to main straight or recurved axis, at base robust, 1–2 mm wide, twisted with cortex occasionally split and gaping, winding in half-circle loops, intertangled, furrowed, with occasional depressions, becoming cylindrical or angular, subcompressed or plane at point of branching, and then cylindrical, shining, olive-brown (or pale brown in shaded portions), dark brown, older branches and base somewhat blackened; apothecia and spermogonia absent, subsection *Sulcatae*.

Anaktuvuk Pass, over exposed gravel and thin soil with *P. birulae*, *C. scholanderii*, *S. globosus*, *P. omphalodes*, growing in mats 15–20 cm wide, on upper slopes (4,000 feet) of quartzite mountain. This species looks somewhat like *A. nitidula* but more robust. Named after Dr. Lawrence Irving, first director of Arctic Research Laboratories, Point Barrow, Alaska, through whose encouragement Alaskan lichen studies were made possible.

7. **Usnea scholanderii** Llano, sp. nov.

Thallus rectus aut subpendulus, ca. 4–6 cm altus aut flocci-formis (1–3 cm) et flaccidus, stramineo- vel pallide viridis, ad basim leniter pallide fuscescens, subconstrictus, dense et irregulariter, dein subsympodialiter ramosus; rami primarii usque ad 0.5–1 (–2) mm crassi, teretes, creberrimi, sat attenuatim subfibrillosi, cortice non rimoso, plerumque ad basim papillati, papillis minutissimis, ad ramos tenuiores rarioribus, ad apices subpapillati vel glabri, valde sorediati; soredia primum parva, farinosa, maniciformiter unita, dein soralia magna (1–2 mm. lata) numerosa, globosa alba vel albo-flava fibrillulis multis radiantibus praedita efformantia; apothecia et spermogonia non visa; medulla K–, cortex K–, soralia K + ferrugineo-brunnea.

Thallus erect to somewhat pendulous, 4–6 cm long, somewhat flaccid, tuft-like (1–3 cm high), straw- to yellowish-green, base somewhat stained rusty-brown, somewhat constricted, densely irregularly branched, cylindrical, becoming subsympodial, apically attenuate, subfibrillose, cortex usually papillate at base, subpapillate to smooth apically, not cracked, strongly sorediate, at first small, farinose, uniting to maniciform type, then forming numerous, large (1–2 mm wide), globose soralia, white- to white-yellow, with many radiating fibrils; apothecia and spermogonia not seen; medulla K–, cortex K–, soralia K + rusty-brown.

On rocks, with *P. sulcata*, common, Lake Peters (ca. Lake Schrader) leg. P. F. Scholander, July 1948. Not to be confused with *U. sorediifera*, *U. glabatra*, *U. vainioi*, or others listed by Motyka under stirps *U. sorediiferae*. Usneaceae are apparently scarce on the North Slope.

In accordance with the Rules of International Nomenclature, the following new names are proposed:

1. **Cetraria magnussonii** Llano, nom. nov. *Cetraria arctica* H. Magn., in Svensk Tidskr. **30**: 251. 1936, is a later homonym of *Cetraria arctica* (Hook.) Tuck. Magnusson's species is

described from material collected in the Yenisei region of Siberia and is quite distinct from the Tuckerman species which is now referred to the genus *Dactylina* Nyl.

2. **Evernia perfragilis** Llano, nom. nov.
Alectoria arctica Elenk. & Sav. Acta Horti Petrop. **32**: 73. pl. 1, fig. 1–3. 1912.
Evernia arctica (Elenk. & Sav.) Lynge in Lich. Nov. Zemlya 209. 1928.

The type material and subsequent collections from Novaya Zemlya, as well as Alaska, are all sterile. The author concurs with Lynge and Du Rietz[3] in believing that this species is, morphologically, more closely allied to the genus *Evernia*. However, the specific epithet is a later homonym of *Evernia arctica* (Hook.) Tuck., i.e., *Dactylina arctica* (Hook.) Tuck.

The distribution of lichen species in Fenno Scandia, in the Arctic islands north of Europe, and on the east and west coasts of southern Greenland are better known than those of Siberia, Alaska, and the Canadian Arctic Archipelago. Even so, the work of Scandinavians on occasional collections from the Canadian Archipelago and similarly of the Russians from rare Siberian collections has given some hints of the probable distribution of lichen species throughout the circumpolar area. Northern Alaska has long represented a vacuum in our understanding of even the commoner species, and has contributed little to add to continuous distributional studies of lichens. For this reason, collections from Arctic Alaska invariably contain new distributions, mainly northern extensions of species. The following anomalous distributions are of unusual interest since they would indicate a geographical pattern of Siberian species extending into North America.

Parmelia birulae Elenk., described from material collected in Novaya Zemlya, is a common element of the north slope of the Brooks Range. Material described to the author by N. Hale from his Baffinland collections of 1950 would indicate that this species extends throughout this range, and possibly to northern Greenland. An equally ubiquitous species is *Cetraria chrysantha* Tuck. with a similar extension. *Cetraria sibirica* H. Magn., first described from the Yenisei Region, Siberia, was collected at Umiat, although it was not seen in the Brooks Range proper. A close relative, *C. magnussonii*, also from the Yenisei, should be looked for in Arctic Alaska. *Evernia perfragilis*, reported only from Novaya Zemlya, is represented in Alaska from two collections at Anaktuvuk Pass. *Ramalina almquistii* Vain., first described from St. Lawrence Island, later reported by Degelius from Hulten's Aleutian collections, is a common species on the North Slope. This suggests that it may be noted inland or on the Siberian coast.

A further example of this type of distribution and also of disrupted range is *Umbilicaria caroliniana* Tuck. Originally described from Grandfather Mountain, N. C., it is now known to exist on Mount Mitchell and Roan Mountain, N. C. Later, it was reported from Japan, and then from the Amur District, Siberia. In a recent publication by the author,[4] it is reported a common element of the lichen flora on conglomerate, sandstone, and quartzite throughout the north slope of the Brooks Range. Its eastern North American terminus is recognized as a classical relict plant area; its eastern Asiatic terminus represents a weakly, if at all, glaciated area. The Alaskan finds are from a similarly poor or nonglaciated region from Kiana (collections of L. J. Palmer) and the Seward Peninsula east along the north slope of the mountain ranges to Lake Schrader. The intervening absence of the species from northern Alaska to North Carolina would appear to have been the direct result of the last extensive glaciation. The absence of records from localities in North Carolina north along the Appalachians to about the southernmost extension of the ice sheet, about latitude 40°N., does not remove the possibility that it may yet be found to have a more general distribution in eastern United States. It may possibly be reported from areas between Alaska and North Carolina but the examination of hundreds of specimens of Umbilicariaceae from these areas would appear to exclude this assumption.

[3] DU RIETZ, G. E., Ark. Bot. **20**(11). 1926.

[4] *A monograph of the family Umbilicariaceae in the Western Hemisphere*, 281 pp., 30 maps, 18 pl., and additional figures. Office of Naval Research, Department of the Navy, October 1950. Copies may be requested from the Department of Botany, Smithsonian Institution, Washington 25, D.C.

Dr. Evans will report more fully upon the Cladoniaceae. However, three new records include *Cl. metacorallijera* Asahina, *Cl. gonecha* (Ach.) Asahina, and *Cl. pseudomacilenta* Asahina.

Among the Physciaceae collected, the following species were all noted from the North Slope: *P. aipolia* (Ehrh.) Hampe, *P. tenella* (Scop.) Bitt., *P. ciliata* (Hoffm.) DR., and *P. teretiuscula* (Ach.) Lynge.

Scholander in 1948 collected two species of *Lobaria* at Bethel on the Kuskokwim River, *L. scrobiculata* (Scop.) Gartner and *L. hallii* (Tuck.) Zahlbr. These are new but expected distributions on the northwest coast of Alaska. However, he also collected the first species at Lake Peters and the second species at Lake Chandler about 30 miles from Anaktuvuk Pass. The distribution of *L. hallii* is most interesting, for since it was first described by Tuckerman from material sent him by the Rev. Hall from Oregon, it has also been recorded in rare instances from southernmost Greenland and northern Scandinavia.

BOTANY.—*New or critical Euphorbiaceae from eastern Asia.* HSÜAN KENG, Department of Botany, National Taiwan University, Taiwan, China. (Communicated by Egbert H. Walker.)

This paper consists of descriptions of some new species and varieties and a new genus from eastern Asia, as well as critical notes and new records, reductions, and combinations. The types of the forms herein described are all preserved in the herbarium of the National Taiwan University, Taiwan, China. Specimens designated "FRI" belong to the Taiwan Forestry Research Institute.

Phyllanthus Linn.

1. **Phyllanthus indicus** (Delz.) Muell. Arg. in Linnaea **32**: 52. 1863; Merr., Enum. Philipine Fl. Pl. **2**: 392. 1923; Kanehira, Formos. Trees, rev. ed., 355. *f. 311.* 1936.

   Glochidion longipedicellatum Yamamoto in Journ. Soc. Trop. Agr. **5**: 178. 1933; S. Suzuki in Masamune, Short Fl. Formosa 121. 1936. (New synonym.)

   TAIWAN: Lutung, Taipei, *Yoshimude 27128* (FRI); Shinrin-chun, Kaoshiung, *S. Sasaki 27137* (type of *G. longipedicellatum*), November 1927.

Glochidion Forster

1. **Glochidion fortunei** Hance var. **longistylum**, var. nov.

   A typo speciei stylo longiore, 4–5 mm longo, differt.

   Leaves elliptic-ovate, the apex caudate-acute, apiculate, the base cuneate or acute, 3–5 cm long, 2–3 cm wide. Capsules 8–10 mm in diameter, 5–6-celled; persistent calyx about 5 mm in diameter; calyx-lobes oblong, acute; style-column 3–4.5 mm long, thickened and 5–6-lobed at the apex; pedicels 5–6 mm long.

   TAIWAN: Chisan, Kaoshiung, *Yamamoto & Mori 760*, August 14, 1936.

   A variety characterized by the much longer styles.

2. **Glochidion fortunei** Hance var. **megacarpum**, var. nov.

   A typo speciei capsula majore, 12–14 mm diametro, differt.

   Leaves rounded-ovate, 2–5.5 cm long, 1.5–2.5 cm wide, the apex rounded or obtuse, mucronate, the base cuneate, acute. Capsules 12–14 mm in diameter, 5–6 mm long; persistent calyx 4–5 mm in diameter; pedicels 3–5 mm long, rather stout.

   TAIWAN: Kaoshiung-wan, Kaoshiung, *Kudo & Suzuki 96*. April 8, 1929.

   A variety characterized by the much larger capsules, about 5–6 mm in length and 12–14 mm in diameter.

Agyneia Linn.

1. **Agyneia taiwaniana**, sp. nov.

   Agyneia bacciformis A. Juss. misapplied by Hayata, Icon. Pl. Formosa **9**: 95. 1920; Suzuki in Masamune, Short Fl. Formosa 118. 1936.

   Herba prostrata, glabra; rami et ramuli compresso-angulati. Folia parva, alternata, elliptica vel oblongo-elliptica vel lanceolata, 1–2 cm longa, 0.4–1 cm lata, apice obtusa vel acuta et mucronata, basi obtusa vel acuta; costae secundariae subdistinctae; petioli vix 1 mm longi. Flores ♂ 1.5 mm diametro, sepalis

oblongo-ovatis 0.8–1 mm longis apice albo-membranaceis cincti, glanduloso-striolati; stamina 3, filamentis omnino in columnam connatis; pedicelli 1.5 mm longi. Flores ♀ 4.5–4.5 mm lati, sepalis oblongo-lanceolatis, 2 mm longis, acuminatis; ovarium cylindrico-obconicum, 1–1.2 mm longum, 1 mm latum, apice latum, obscure depressum; styli 3, liberi, divergentes, bifidi. Capsula subglobosa vel ovoidea, 4–4.5 mm longa, 3–4 mm lata.

Taiwan, abundant on the west coast of the south-central part of the island, near Chiayi, Tainan, and Hengchun.

TAIWAN: Peimen-chüan, Tidi-liu, Tainan, *K. Mori 110* (type), December 26, 1940; Anpin, Tainan, *Soma 14420* (FRI); Peimen, Chi-gou, Tainan, *K. Mori 530;* Chiayi, Tainan, *H. Keng 1375;* Hengchun, *H. Keng 322.*

A species formerly identified by Hayata as *A. bacciformis*, which is a species widely distributed over southern China (?), Java, Ceylon, India, and Maritius. No authentic Indian specimens have been examined, but when compared with the descriptions of *A. bacciformis* by Hooker (Fl. Brit. Ind. **5**: 285. 1890) and Pax and Hoffman (in Engler, Pflanzenr. **81**: 213. 1922) and with the illustrations by Wight (Icon. Orien. *pl. 1992.* 1852) and Pax and Hoffman (l.c. 213. *f.18*), this new species appears to differ chiefly in the cylindrico-obconical ovary and the smaller fruits. The ovary of *A. bacciformis* is broadly ovoid and the fruit is about 6 mm long and 5 mm wide. The sizes of the floral parts of both sexes also do not agree in these two species.

2. **Agyneia goniocladus** (Merr. & Chun), comb. nov.

Phyllanthus goniocladus Merr. & Chun in Sunyatsenia **2**: 260. *f. 51,* 1935; Tanaka & Odashima in Journ. Soc. Trop. Agr. 372. 1938; Masamune, Fl. Kainan. 169. 1943.

HAINAN: Tung-koo-shan, *H. Fung 20418* (paratype of *P. goniocladus*); *Masamune & Fukuyama 4,* November, 1940.

In this species the male sepals are thick, with white margins, and the styles are small on the excavate top of the ovary. These are critical characters of *Agyneia*, rather than of *Phyllanthus.*

This species can also be separated from the Formosan *A. taiwaniana* in the subcylindrical ovary and the much shorter filament columns. The *Agyneia* of southern China, as cited by Pax and Hoffman from Kwangtung and Hongkong (l. c. 214), is very probably referable to this species.

Liodendron, gen. nov.

Arbores vel frutices. Folia alterna, crenulato-serrulata vel integerrima, membranacea vel coriacea, tenuiter pennivenia et reticulato-venosa. Flores axillares, dioici, apetali, disco nullo, ♂ racemosi vel spicati, brevissime pedicellati; ♀ longius pedicellati, solitarii. Fl. ♂: calyx tenuis, 4–6-partita, segmentis inequalibus, imbricatis; stamina 2, filamentis compressis; antherae globoso-ellipsoideae, erectae, extrosae, loculis distinctis, parallelis, longitudinaliter dehiscentibus; ovarii rudimentum O. Fl. ♀: calyx tenuis, 5-partita, segmentis augustis; ovarium oblongo-ovoideum, 3-loculare; ovula in loculis gemina; styli longiusculi, in ramos ubique carnosos papillosos expansi. Drupa oblongo-ovoidea, endocarpio duro, fere osseo, abortu 1-locularia, 1-sperma. Semina oblongo-ovoidea; testa crustacea, albumen carnosum; embryo rectus, cotyledonibus latis, planis.

Type species: *Liodendron matsumurae* (Koidzumi), comb. nov., infra.

This new genus is very near *Putranjiva*, from which it differs in the male flowers being in axillary racemes and in the definitely 2 stamens, while in *Putranjiva*, the male flowers are solitary or in axillary clusters, never in racemes or in spikes, and the number of stamens is 2–4.

The arrangement of flowers in spikes or racemes, especially in the staminate plants, is an important character in the classification of the Euphorbiaceae. Bentham, for instance, in his treatment of the Australian Euphoribiaceae, divides this family into 5 tribes, tribe 3 (Antidesmeae) differing from tribe 4 (Phyllantheae) merely in the "flowers small, in catkin-like spikes or in racemes" in one, and the "flowers in axillary clusters or solitary" in the other (cf. Bentham, Fl. Austral. **6**: 42. 1875).

Again, Pax and Hoffmann, in their monograph of the Euphoribiaceae, divide the tribe Phyllantheae into 22 subtribes, the first subtribe (Antidesminae) being distinguished from the other 21 subtribes (*Putranjiva* is contained in the second subtribe Glochidiinae) only in the character of the inflorescence being spicate, racemose or paniculate (cf. Pax & Hoffman in Engler & Prantl, Pflanzenfam. Ed. 2, **19c**: 31. 1931).

The systematic position of this new genus is an

interesting one, as it agrees with the Antidesminae of Pax in the male flowers being in spikelike racemes, yet it differs from it in the total absence of disks or glands in flowers of both sexes.

Formerly the genus *Putranjiva* contained four species and was considered as occupying a discontinuous area (cf. Pax & Hoffmann in l. c. **19c**: 59. 1931). *Putranjiva roxburghii* Wallich is found in India, *P. zeylanica* Muell. Arg. in Ceylon, *P. matsumurae* Koidz. in the Liukiu Islands, and *P. integerrima* Koidz. in the Bonin Islands. In the present treatment the latter two species are transferred to *Liodendron*, as *L. matsumurae* (Koidz.) and *L. integerrimum* (Koidz.), respectively. In addition there is the Formosan species *L. formosanum*. These species show that *Putranjiva* and *Liodendron* occupy two separate natural phytogeographic regions, namely, *Putranjiva* in India and Ceylon and *Liodendron* in the Bonin and Liukiu Islands and in Formosa. The establishment of this new genus confirms the phytogeographical relationship between Formosa-Liukiu and the Bonin Islands.

The genus is named in honor of Dr. Hui-Lin Li, of the National Taiwan University, in appreciation of his extensive contributions to our knowledge of the flora of eastern Asia.

1. **Liodendron matsumurae** (Koidzumi), comb. nov.

Putranjiva roxburghii Wallich, misapplied by Matsumura in Bot. Mag. Tokyo **12**: 61. 1898; Hayata in Journ. Coll. Sci. Univ. Tokyo **20**(3): 25. *pl. 2H*. 1901.

Putranjiva matsumurae Koidzumi in Bot. Mag. Mag. Tokyo **33**: 116. 1919, not Suzuki in Sylvia **4**(3): 129. 1930, in Masamune, Short Fl. Formosa 122. 1936.

A species known only from the Liukiu Islands. S. Suzuki reports the presence of it in Formosa. Two of his cited specimens were examined, one, Taroko, Ariko-banti, *Matsuda 1184*, is a fruiting specimen of *Eleocarpus decipiens* Hemsley; the other, Kwasyoto, *Kudo & Mori 1784*, is nothing more than a sterile specimen of *Liodendron formosanum*.

LIUKIU ISLANDS: *Herb. No. 22377* (fruiting fragment presented by the herbarium of Tokyo Imp. Univ., collector and date unknown); Amami-Osima, *Tashiro 27737*.

2. **Liodendron integerrimum** (Koidzumi), comb. nov.

Putranjiva integerrima Koidzumi in Bot. Mag. Tokyo **33**: 117. 1919; Nakai in Bull. Biogeogr. Soc. Japan **1**: 259. 1930.

A species known only from the Bonin Islands.

3. **Liodendron formosanum** (Kanehira & Sasaki), comb. nov.

Putranjiva formosana Kaneh. & Sasaki in Sasaki, Cat. Gov. Herb. Formosa 312. 1930, nomen; Simada in Trans. Nat. Hist. Soc. Formosa **24**: 83. 1934; Suzuki in Masamune, Short Fl. Formosa 122. 1936.

Drypetes formosana (Kaneh. & Sasaki) Kanehira, Formos. Trees, rev. ed., 336. *f. 929*. 1936.

Putranjiva roxburghii Wallich, misapplied by Hayata, l. c. 25. 1904, as to Formosan plants.

Putranjiva matsumurae Koidzumi misapplied by Suzuki in Sylvia **4**(2): 129. 1933 in Masamune, Short Fl. Formos. 122. 1936, as to Formosan plants.

Small tree, the branches slender, terete, glabrous, the branchlets sulcate, obscurely pubescent. Leaves elliptic to oblong-ovate, 5–8 cm long, 3–5 cm wide, the apex acuminate, the base obliquely acute, membranaceous at first, later coriaceous, the margins entire to crenulate-serrulate; petioles 7 mm long. Male flowers spicate-racemose, axillary, 6–8 cm long, velutinous; bracts 2–3-flowered. Female flowers in bud elliptical, shortly pedicellate, 1 mm long; sepals 4–6, unequal, hispid, imbricate; stamens 2; mature female flowers not seen. Drupe ovoid-ellipsoid, 10–13 mm long, 7–8 mm across, appressed white-pubescent, 1-locular, 1-seeded.

A species known only from Formosa.

TAIWAN: Sinchashek, Sinchu, *Kanehira & Sasaki 27130* (syntype of *Putranjiva formosana* Kaneh. & Sasaki); *Sasaki 7292*, September 21, 1927; Chukong, Sinchu, *Sasaki 7291*, January 1927; Komo, Sinchu, *Kudo & Sasaki 140* (type of ♂ inflorescence), April 9, 1929.

The following specimens are sterile, the size of the leaves being larger than the normal forms, and they are probably taken from the lower branches or basal sprouts: Sizangan, Taipei, *Nonaka & Kudo 2391;* Kizan, Taipei, *Masamune & Suzuki 2393;* Hoshautau, *Kudo & Mori 1784;* Botel Tobago, *Hosokawa 3186*.

Kanehira and Sasaki first proposed this species as *Putranjiva formosana*. Six years later Kanehira transferred it into *Drypetes formosana*, but such characters as the two stamens in the male flower, the 1-celled, 1-seeded fruit, and the male

flowers being in spikelike racemes readily separate it from *Drypetes*. In the latter, the stamens are 2–4, the fruits are 2–4-celled, 2-seeded, and the male flowers are clustered and axillary.

This species is clearly related to *Liodendron matsumurae*, yet it may be readily separated by the larger leaves and smaller fruits. The latter species has elliptic-oblong leaves, 4–6 cm long, 2–3.5 cm wide, and ovoid fruits, 1.5–2 cm long, 0.8–1.3 cm wide, and is confined to the Liukiu Islands.

Drypetes Vahl.

1. **Drypetes falcata** (Merr.) Pax in Engler, Pflanzenr. **81** (VI.147.XV): 250. 1922.
Cyclostemon falcatus Merr. in Phillippine Journ. Sci. **3**: 415. 1908; Enum. Philippine Fl. Pl. **2**: 406. 1923.
Drypetes yamadai Kanehira & Sasaki in Trans. Nat. Hist. Soc. Formosa **21**: 145. 1931, nomen seminud.; Kanehira, Formos. Trees, rev. ed., 339. *f. 293*. 1936; Suzuki in Masamune, Short Fl. Formosa 119. 1936. (New synomym.)

Taiwan; Hengchun Peninsula, in thickets and forests along the seashore.

TAIWAN: Kuraru, *Yamada 14573* (syntype of *D. yamadai*, FRI); *Konishi 14574* (FRI); *Matuda 112;* Olungbi, *Hibino & Suzuki 12586, 12702; Kimiya 14575* (FRI); *Kudo & Suzuki 15815; H. Keng 1394*.

There is not sufficient difference between *D. yamadai* and *D. falcata* to treat them as distinct species. Kanehira states (in Trans. Nat. Hist. Soc. Formosa **21**: 145. 1931) that the former is "very near *Cyclostemon falcata* Merr., but differs in having glabrous fruits." However, after examining the syntype and a fruiting specimen from the type locality, *Matuda 112*, I find that the fruit is appressed-pubescent, rather than glabrous. In Merrill's original description, it is stated: "Fructus axillares, solitarii, pedicellis 5–7 mm longis." In Formosan plants the fruits are solitary or rarely 3–4-clustered and the fruit-stalks are usually 1 cm long, sometimes up to 1.5 cm long.

D. falcata in the Philippines is known only from Camiguin, a small island of the Babuyan group, situated between Taiwan and Luzon.

Daphniphyllum Blume

1. **Daphniphyllum crispifolium,** sp. nov.

Folia elliptica vel oblongo-elliptica, 8–10.5 cm longa, 2.5–4 cm lata, apice obtusa, apiculata, basi obtusa vel acuta, spura nitida, subtus papillosa, subglauca, margine valde crispa. Racemi fructiferi 7–8 cm longi. Fructus oblongo-ellipsoideus, 7–8 mm longus, 5–6 mm latus, rugosus, stigmatibus valde circinatis, pedicellis gracilibus 1–1.5 cm longis.

TAIWAN: Nichigetzutan, Taichung, *Kudo & Sasaki 15336a, 15336b* (type), September 19, 1929.

This species is near *D. oldhamii* Rosenth., differing in the strongly cripsed leaf-margins, the longer and more slender fruiting inflorescences and the smaller fruits.

2. **Daphniphyllum reticulatum,** sp. nov.

Folia tenuiter coriacea, obovato-elliptica vel elliptica, 8–9 cm longa, 3–3.5 cm lata, apice cuspidato-obtusa, basi acuta, supra nitida, subtus papillosa, nervis lateralibus untrinsecus 10–20, angulo circiter 60° ortis, rete venularum subtus insigniter prominulo, nervis venisque supra impressis vel prominulis, subtus prominentibus. Racemi fructiferi 6 cm longi. Fructus ellipsoideo-ovideus, circiter 8 mm longus et 5 mm latus, basi et apice rotundatus, apice stigmatiferus, revolutus, pubescens; pedicellis 4–5 mm longis.

TAIWAN: Taroko, Hualien, *S. Suzuki 9880* (type), December 30, 1931; Hengchun, Mount Hiirasan, *E. Matuda 919;* Kuskus, *Kudo & Suzuki 15947*.

A species characterized by the finely reticulate veinlets very prominent on the lower surface of the leaves and by the very short fruiting stalks.

3. **Daphniphyllum formosanum,** sp. nov.

Frutex, ramulis subgracilibus. Folia coriacea, oblonga vel oblongo-elliptica, 4–7 cm longa, 2–2.5 cm lata, apice acuta, apiculata, basi late cuneata, supra nitida, subtus papillosa, costa plana, subtus prominente elevata, nervis lateralibus untrinsecus 12–15, margine subintegra, revoluta vel crispa, petiolis 1.2–2 cm longis, supra leviter canaliculatis. Racemi fructiferi 4–5 cm. longi, graciles. Fructus ovideus, 7–9 mm longus, apice rotundatus, basi acutus, stigmatibus circinatis, persistentibus, calyce basi adnata, 5-dentata, lobis lineari-lanceolatis, crenatis, saepius persistentibus.

TAIWAN: Hikizangan, Taipei, *T. Suzuki 4814*, July 26, 1932; Gukutu, Hualien, *E. Matuda 1155* (Type), August 5, 1918; Naibuntoge, Kaoshiung, *Kudo & Suzuki 1615*, April 10, 1930.

This is the only known species in Formosa with persistent calyx in the fruiting stage. All its characters agree well with that of *D. marchadii* Croizat and Metcalf (in Lingnan Sci. Journ. **20**: 117. 1942) or *D. salicifolium* Chien (in Contr. Biol. Lab. Sci. Soc. China **8**: 242. 1933) of southwestern China, except the much smaller fruits and the longer, circinate stigmas. No authentic specimens of the latter species have been seen. This new species may also be readily separated from *D. oldhamii* by its smaller leaves with prominent apicules at the apex and by the persistent calyx at the base of the fruit.

Mercurialis Linn.

1. **Mercurialis leiocarpa** Sieb. & Succ. var. **transmorrisonensis** (Hayata), comb. nov.
Mercurialis leiocarpa Sieb. & Zucc., misapplied by Hayata in Journ. Coll. Sci. Univ. Tokyo **25**: 194. 1908. S. Suzuki in Sylvia **4**: 143. 1933, in Masamune, Short Fl. Formosa 122. 1936.
Mercurialis transmorrisonensis Hayata, Icon. Pl. Formosa **5**: 199. *f. 75.* 1915.

Taiwan; throughout the island, more common in the central mountain regions.

TAIWAN: Mount Kanin, *Fukuyama 34;* Mount Taiping, *S. Suzuki 383, 3839;* Mount Tentana, *Simada 14992* (FRI); Mount Arisan, *Simada 796;* Mount Dabusan, *Sasaki 2144, Matuda 1500;* Ariko-banti, *Matuda 1199;* Pintung, *Hosokawa 5408;* Taroko, *S. Suzuki 9684;* Mount Nokosan, *Fukuyama 4682.*

The typical form of the species is distributed in Indo-China, Siam, southern China (Yunnan to Hupeh), and Japan. Hayata describes this variety as an independent species and states that it is "very near *M. leiocarpa* Sieb. & Zucc., but differs from it in having less verrucose ovary with the much spreading stigma and the less vetrucose or nearly smooth capsules; the distinction of this plant from *M. leiocarpa* is even more clear in the living specimen." The actual distinctive characters of this Formosan plant are probably in the stamens. The stamens in the typical form are 16–20 (cf. Muell. Arg.) or 14–20 (cf. Pax), whereas in this variety there are only about 10. Furthermore, in this variety the filaments are usually 2–3-connate at the base, showing the tendency to monadelphy.

Alchornea Swartz

1. **Alchornea trewioides** (Benth.) Muell. Arg. var. **formosae** (Muell. Arg.) Pax in Engler, Pflanzenr. **63**: (IV. 147. VIII) 248. 1914.
Alchornea kelungensis Hayata, Icon. Pl. Formosa **9**: 103. 1920; Kanehira, Formosa Trees, rev. ed., 329. 1936; S. Suzuki in Masamune, Short Fl. Formosa 118. 1936. (New synonym.)

TAIWAN: Taipei, *Sasaki 14423;* Keelung, *Matuda 1144, Simada 1145.*

This variety differs from the typical form of the species from southern China chiefly in the shorter (6–8 mm long) and usually 2–3-lobulate styles. In the typical form, the styles are longer (8–12 mm) and entire at the apex.

2. **Alchornea trewioides** (Benth.) Muell. Arg. var. **loochoensis** (Hayata), comb. nov.
Alchornea loochoensis Hayata, Icon. Pl. Formosa **9**: 103. 1920.
Alchornea trewioides Muell. Arg., misapplied by Hayata in Journ. Coll. Sci. Univ. Tokyo **23**: 47. *pl. 4A.* 1904.

LIUKIU ISLANDS: Guo-teu, *Kanesiro 195;* Yu-na-guo-tau, *Simada 14424* (FRI).

This variety can be distinguished from var. *formosae* by the following characters in the female flowers: the lanceolate-acuminate sepals, the globose ovary and the much shorter styles (3 mm long); whereas in the Formosan plants, the sepals are triangular-acuminate, the ovary is depressed globose, and the styles are somewhat longer (6–8 mm long).

Acalypha Linn.

1. **Acalypha** (Sect. Capillipes Muell. Arg.) **hontauyuensis,** sp. nov.

Frutex; ramuli sericeo-tomentosi, consperse sulcati. Folia tenuiter chartacea, longe petiolata, cordato-orbiculata, 12–18 cm longa, 12–16 cm lata, apice cordato-acuminata, basi oblique truncato-cordata, margine crenato-serrata, 5-nervia, utrinque subglabra et ad costam nervosque dense hirsuta, petiolis 8–20 cm longis, gracilibus, sericeo-tomentosis. Spicae fl. ♂ ignotae. Spicae fl. ♀ gracillimae, axillares, solitariae, 6–10 cm longae, pedunculis 0.5–2 cm longis, hirsutis, floribus remotis spicatis, sessilibus, lanceolatis, 3–4 mm longis, hirsutis. Fl. ♀: bractea unica minuta, triangularis, 1 mm longa, extus densissime hirsuta; sepala 3, ovata, 1 mm longa, intus concava, subglabra, extus hirsuta; styli 2.5–3 mm longi, graciles, glabri.

TAIWAN: Hontauyu (Botel Tobago), *Hosokawa 8047* (type), July 4, 1935; *Hosokawa 8165*, July 16, 1935.

This species and *A. suirenbiensis* Yamamoto are characterized by the sessile female flowers with very minute and nonaccrescent bracts, while in the other species of the genus the female flowers when sessile are generally provided with large and showy bracts, usually enclosing the mature capsules.

Euphorbia Linn.

1. **Euphorbia** (Sect. Tithymalus Boiss.) **shouanensis,** sp. nov.

Caules villosi, crassi, erecti. Folia sessilia, membranacea, uninervia, lineari-oblonga vel lineari-lanceolata, 2–5 cm longa, 8–14 mm lata, apice acuta, basi attenuata, subtus pubescentia. Umbellaria primaria ovato-lanceolata, 2.5–5 cm longa. Triplo cymae terminales. Involucrum centrale campanulatum, stipitatum, 3.5 mm longum, 2.5–3 mm diametro, extus glabrum, intus hirtellum, lobis 4 (5 ?), ovato-oblongis, ciliatis, glandulis 4, transversis, reinformibus, stipitatis. Flores ♂ 12, bracteolis spathuliformibus, insertis, margine apicem versus densissime pilosis. Flores ♀ pedicellis elongatis, exserti; ovarium ovoideo-globosum, 2 mm longum, trisulcatum, glandulis verrucosis compressis brevibus conicis obtusissimis obsitum, stylis 3, 2 mm longis, basi brevissime connatis, apice breviter bifidis, stigmatibus subincrassatis. Involucrum sterile 2 mm longum, 1.5 mm diametro; ovarium minutum.

TAIWAN: Shashan, Shouan, Chiayi, Tainan, altitude 1,500 m, *T. Suzuki 20910* type), November 10, 1940.

This species is distinctly characterized by the triplo-cymose inflorescence and the involucral structures. In primary cymes, the umbellate leaves are 5, ovate-lanceolate, 2–5 cm long, 1.5 cm wide and with acute apex; the umbellate branches are 5, the central one being much shorter. In secondary cymes, the umbellate leaves are 3, ovate-rounded, 1.5 cm long, 1 cm wide and with very abtuse apex; the umbellate branches are 3. In tertiary cymes, the umbellate leaves are 3, subrounded, 8 mm long and 7 mm wide. The central fertile involucre is single, naked, campanulate, stalked, 3.5–4 mm long and 2.5–3 mm in diameter. Lateral sterile involucres are 3, turbinate, 2 mm long, 1.5 mm in diameter and short-stalked, each concealed in 2 clasping floral leaves (or bracts) opposite to the tertiary umbellate leaves.

In the central fertile involucre, the lobes are 4 (5 ?) ovate-oblong, the glands are 4, transversely reniform, and substalked. Male flowers are about 12. The ovary is ovoid-globose, exserted, and the styles are nearly free except at the very base. In lateral sterile involucres, the lobes and glands are not very distinct, the rudimentary flowers are numerous and the rudimentary ovary is included.

2. **Euphorbia prostrata** Ait., Hort. Kew. **2:** 136. 1789; Bernard, Icon. Bogor. **4:** 51. *pl. 316.* 1916; Merr., Enum. Philippine Fl. Pl. **2:** 463. 1928.

Euphorbia liukiuensis Hayata, misapplied by Sasaki, Cat. Gov. Herb. Formosa 305. 1930; Suzuki in Sylvia **4:** 155. 1933, in Masamune, Short, Fl. Formosa 119. 1935.

Chamaesyce liukiuensis (Hayata) Hara in Journ. Jap. Bot. **14:** 356. 1938.

Taiwan, distributed nearly throughout the whole island, pantropical.

TAIWAN: Northern part, *S. Suzuki 12414, 12257, Masamune & Suzuki 1742, Mori 8379, Simada 1733, 1736, 3211, Sasaki 1741;* southern part, *Simada 14678* (FRI), *Mori 101, Hosokawa 1939, 1941;* eastern part, *S. Suzuki 1277, 1667, 10607;* Pescadores, *Kudo & Mori 3070, Cheng 3071.*

This is a new record for the flora of Formosa. This species is similar in general appearance to *E. thymifolia,* but it may be distinguished from the latter by the longer stalks of the involucre, the more prominent persistent columnella of the cocci, the shorter stalks of the glands, and the less hirsute cocci.

I have not seen the type of Hayata's *E. liukiuensis,* a species of Liukiu. However, the four specimens deposited in the herbarium of the Taiwan Forestry Research Institute, i.e., *Hiratuka 14676, Soma 14677, Simada 14678,* and *Yasukawa 14679,* all from Taiwan and determined by S. Sasaki as doubtfully of this species, agree exactly with *E. prostrata.*

ZOOLOGY.—*New distributional records for two athecate hydroids,* Cordylophora lacustris *and* Candelabrum *sp., from the west coast of North America, with revisions of their nomenclature.* CADET HAND, Mills College, Oakland, and University of California, Berkeley, and G. F. GWILLIAM, University of California, Berkeley. (Communicated by F. M. Bayer.)

I. CORDYLOPHORA

In August 1950 an unidentified hydroid was found in a collection at the University of California at Berkeley. The label bore no collection date or collector's name, but it did report the locality from which the animal was taken as Antioch, Calif., which is located on the San Joaquin River 5 miles upstream from its junction with the Sacramento River.The hydroid was subsequently identified as the widely distributed fresh- and brackish-water form, *Cordylophora lacustris* Allman.

On August 26, 1950, the writers found this hydroid growing on pieces of old manila rope suspended from a floating dock in the San Joaquin River at Antioch. The ropes were literally covered with colonies of varying sizes. A sample of the river water taken at this time showed a chlorinity of 1.02 parts per thousand (5.4 per cent of sea water).

What appears to be the first recognizable description of this hydroid was that of Allman (1844), who found it in the docks of the Grand Canal, Dublin, Ireland. Roch (1924) in a paper dealing with many aspects of the biology of this hydroid reviewed its distribution, listing the following general localities in which *Cordylophora* occurred: Germany, Holland, Denmark, Sweden, Finland, Esthonia, Courland (now part of Lithuania), Russia, France, Belgium, England, Ireland, United States, Brazil, Egypt, Australia, Tasmania, New Zealand, China.

In North America, Leidy (1870) first detected this hydroid at Newport, R. I., and later in the vicinity of Philadelphia, Pa. Since that time *C. lacustris* has been found in several localities in North America, some of them a considerable distance inland.

Fraser (1944, p. 35) reports the American distribution as: "Newport, R. I. (Leidy); St. Andrews, Gaspé, Seven Islands (Stafford); New England (Kingsley); Woods Hole (Nutting); several ponds near Woods Hole, Marthas Vineyard (Hargitt); Miramichi estuary, Frenier Beach, La. (Fraser); Gatun locks, Panama canal." In addition, Ward and Whipple (1945) list the following: Illinois River at Havana, Ill.; Mississippi River at Granite City and at East St. Louis, Ill.; Arkansas River at Little Rock, Ark.; and the Red River at Shreveport, La.

The present report is the first record of the existence of this organism on the west coast of North America. This was not entirely unexpected, as Fraser (1946, p. 101) stated: "It has not yet been reported from the eastern Pacific, but it has extended along the whole length of the North American Atlantic, and as it has entered the Panama canal as far as the Gatun locks, it may show up in the Pacific before long."

Several varieties of *C. lacustris* have been described. Schulze (1921) mentions the forms *albicola*, *transiens*, and *whiteleggei*. Fyfe (1929) described a new subspecies (*otagoensis*) from New Zealand. Earlier Leidy (1870) gave to what he recognized as a small variety of *C. lacustris* the name *C. americana*. Briggs (1931) points out that *C. lacustris* is extremely variable in growth form and that growth form may depend upon salinity. It appears that all the named subspecies and forms of *C. lacustris* are nothing more than variations in habit. The present writers have found such extensive variation in the specimens studied that the recognition of named varieties seems to have no taxonomic significance.

There is some doubt as to whether the proper specific name of *Cordylophora* is *lacustris* or *caspia*. Pallas (1771) described a hydroid from the Caspian Sea as *Tubularia caspia*. This is said by some to be identical with *C. lacustris* Allman (Roch, 1924; Cordero, 1941). Other writers feel that Pallas' description is too vague to permit an exact diagnosis (Briggs, 1931; Bedot as quoted by Briggs) and prefer to retain *C. lacustris*.

The present writers have studied the Pallas description and find it so generalized that it might as well refer to many other

hydroids as to *C. lacustris*. Further, there seem to be no valid records of this hydroid from the Caspian Sea since the time of Pallas. Because of this, coupled with the fact that *C. lacustris* Allman has had such wide usage, the present writers choose to retain Allman's name until it can be clearly shown that *Tubularia caspia* Pallas is identical with *Cordylophora lacustris* Allman.

Another nomenclatural problem is brought up by Finlay (1928). Finlay declares that the family Clavidae to which *Cordylophora* belongs is an invalid name due to preoccupation by the gastropod genus *Clava* Martyn (1784) over the hydroid genus *Clava* Gmelin (1791). Finlay suggests that the name Clavidae be replaced by the name Cordylophoridae, *Cordylophora* being the next available generic name. This solution changes the type genus of the family, an action for which there is no valid taxonomic reason, and, further, Finlay fails to reassign the species of *Clava* (the hydroids) to any other genus. In considering this matter it has been pointed out to us by Dr. H. A. Rehder, curator of mollusks, U. S. National Museum, that the system used by Martyn in his "Universal Conchologist" is non-Linnaean, and that Martyn's names are therefore not available and do not preoccupy. The change suggested by Finlay (*op. cit.*) was therefore unnecessary, and the hydroid genus *Clava* Gmelin (1791) stands as the valid type of the family Clavidae.

Material from the University of California collection (U.S.N.M. no. 49727), the San Pablo Reservoir, and fresh material from Antioch (U.S.N.M. no. 49726) has been carefully examined and compared and no characters separating these from *C. lacustris* have been found.

Family CLAVIDAE

Genus **Cordylophora** Allman, 1844

Cordylophora lacustris Allman

Colony: Growth form variable. Sometimes a main axis with hydranths given off alternately, sometimes more diffuse and irregular, or colony branched, lacking a main axis. Hydrocaulus arising from creeping hydrorhizae. Perisarc well developed. Longest hydrocaulus observed approximately 6 cm.

Trophosome: Hydranth clavate, pedicellate, with up to 30 scattered, filiform tentacles. Perisarc at bases of pedicels often annulated, but occasionally smooth or "corrugated" on one side only. Perisarc extending only to base of hydranth. Tentacles quite extensile, mouth terminal. Nematocysts; desmonemes (4.0–6.0 by 3.0–4.0μ) and microbasic euryteles (7.5–11.0 by 4.0–4.5μ).

Gonosome: Dioecious. Sporosacs sessile or borne on short pedicels which may or may not be annulated at their bases as in trophosome. Gonophores enclosed in a thin perisarc, and arise from hydrocauli or pedicels. In the female the eggs are extruded from the generative tissue into a jelly-like mass. The generative tissue regresses as the eggs are extruded, finally leaving a variable number (approximately 1–8) of recognizable ova. At this site the ova develop into planulae and are then released. In general, the female gonophores tend to be more spherical than the male. In life female gonophores pinkish, male whitish.

Habitat and distribution: On sticks, ropes, floating docks, etc. in fresh or brackish water. In California, *C. lacustris* occurs at An'ioch, and has been reported from Lake Merced, San Francisco (Dr. R. C. Miller, California Acad. Sci., personal communication) and from the San Pablo reservoir system, El Cerrito, California (Dr. H. Kirby, Jr., Univ. California, Berkeley, personal communication). Also, according to Dr. T. Kincaid, Univ. Washington, Seattle (*in litt.*) this species occurs in the Puget Sound area. It has evidently been in California for a number of years. The old University of California specimen mentioned above is thought to be 20 to 40 years old.

II. CANDELABRUM

On May 6, 1950, three specimens of *Candelabrum* sp. (= *Myriothela* sp.) were collected from a pholad hole on the undersurface of a rock at approximately the zero foot tide level (mean lower low water) at Pigeon Point, San Mateo County, Calif. The authors do not feel that this is sufficient material to warrant specific identification, especially since none of the polyps bear mature gonophores. Several attempts were made to obtain more material, but thorough searching has failed to reveal the presence of further specimens. It may be that it is a stray in the intertidal zone and exists in numbers subtidally. Some indication of this may be gained from the fact that several

of the known species of *Candelabrum* are subtidal forms. Of the generic identification, we feel that there is no doubt.

As nearly as the authors have been able to determine there are now nine valid species of this genus. The first was described as *Lucernaria phrygia* by Fabricius (1780). This was later redescribed by Sars (1850), apparently unaware of Fabricius' description, as *Myriothela arctica*. De Blainville (1830; reprinted, 1834) realized that Fabricius' animal was not a *Lucernaria* and proposed the name *Candelabrum* for it. He indicated at the same time that it was related to the Sipunculids. Allman (1872, p. 381) states: "De Blainville, seeing that Fabricius's animal had no relation with *Lucernaria*, constituted for it, in 1834, his genus *Candelabrum*, and as this name has priority over *Myriothela*, it is accepted by Agassiz as the legitimate name of the genus." Allman goes on to explain that De Blainville did not recognize its true affinities, while Sars did. He chooses to retain *Myriothela* Sars in spite of the law of priority, an action that the present authors do not deem justified. The replacement of the name *Myriothela* by *Candelabrum* necessitates the renaming of this monogeneric family, which we now designate as the Candelabridae (= Myriothelidae Allman).

In addition to *Candelabrum phrygium*, the other known species and the localities from which they were taken are: *C. mitrum* (off coast of Norway near Bergen, deep water, Bonnevie, 1898); *C. minutum* (near Tromsö, Norway, intertidal?, Bonnevie, 1898); *C. verrucosum* (locality not given, Bonnevie, 1898); *C. giganteum* (Greenland Sea, deep water, Bonnevie, 1898); *C. austrogeorgiae* (off Cumberland Bay, South Georgia Island, deep water, Jäderholm, 1904); *C. cocksii* (Falmouth, England, intertidal, Cocks, 1849, as a nomen nudum; Cocks, 1853, name validated); *C. harrisoni* (New South Wales, Australia, intertidal, Briggs, 1928); *C. australe* (New South Wales, Australia, intertidal, Briggs, 1928).

Fraser (1946, p. 168) reports that only one species is known from North America (*C. pyrygium*) and states concerning it: "The only American location so far reported is off Grand Manan Island, at the mouth of the bay of Fundy, but its range extends eastward by way of Greenland and Iceland to Great Britain, Norway, Nova Zembla, and the Siberian Polar Sea."

Family CANDELABRIDAE, nom. nov.

Genus **Candelabrum** de Blainville, 1830

Candelabrum, sp. ind.

U. S. N. M. no. 49725.

Hydranth: Not branched, solitary, naked and arising from a creeping hydrorhiza or possibly a disc. Hydrorhizae invested with perisarc. Exclusive of hydrorhizae, polyp divisible into two zones; a distal tentacle-bearing zone and a proximal tentacle-free blastostylar zone. The tentacle-bearing zone composes five-sixths or more of the polyp length and bears approximately 500 tentacles in the adult; cylindrical, approximately the same diameter throughout. Tentacles densely packed, short, capitate and not arranged in any discernible pattern. Mouth terminal. Blastostylar zone swollen, of a slightly greater diameter than the tentacle bearing zone. Sometimes separated from tentacle-bearing zone by a constriction; at the proximal end tapering sharply to hydrorhiza. Structures referred to by Allman (1875) as "claspers" not present on specimens examined. Blastostyles giving rise to more than one gonophore. Largest specimen (preserved) 2.5 cm long by 0.15 cm. in diameter (including the tentacle .)

Of the known species of *Candelabrum*, the species described above most closely resembles *Candelabrum harrisoni* Briggs. In fact there are no obvious differences, but in view of the unusual distribution which Briggs' species would then have, plus the paucity of material available, it does not seem wise to make the two conspecific at this time.

LITERATURE CITED

ALLMAN, G. J. *Synopsis of the genera and species of zoophytes inhabiting the fresh waters of Ireland.* Ann. Nat. Hist. (1) **13:** 328–333. 1844.

———. *A monograph of gymnoblastic or tubularian hydroids* **2:** 381–383. 1872.

———. *On the structure and development of* Myriothela. Phil. Trans. Roy. Soc. London **165** (2): 549–572. 1875.

BLAINVILLE, H. M. D. DE. *Dictionnaire des sciences naturelles* **60:** 284. 1830.

———. *Manuel d'actinologie.* Paris, 1834.

BONNEVIE, K. *Zur Systematik der Hydroiden.* Zeitschr. für Wiss. Zool. **63:** 465–493. 1898.

BRIGGS, E. A. *Studies in Australian athecate hydroids.* Rec. Austral. Mus. Sydney **16:** 305–315. 1928.

——. *Notes on Australian athecate hydroids*. Rec. Austral. Mus. Sydney. **18:** 279–282. 1931.

COCKS, W. P. *Contributions to the fauna of Falmouth*. Ann. Rep. Roy. Cornwall Polytech. Soc. **17:** 38–102. 1849.

——. *Contributions to the fauna of Falmouth, 1853*. Ann. Rep. Roy. Cornwall Polytech Soc. **21:** 28–36. 1853.

CORDERO, E. H. *Observaciones sobre algunas especies sudamericanas de gènero* Hydra. II. Hydra *y* Cordylophora *en el Uruguay*. Ann. Acad. Brasil. Sci. **13:** 173–184 figs. 1–26. 1941.

FABRICIUS, O. *Fauna Groenlandica*. 1780.

FINLAY, H. J. *Notes on New Zealand and Australian gymnoblastic hydroids*. Austral. Zool. **5:** 257–261. 1928.

FRASER, C. M. *Hydroids of the Atlantic coast of North America*. Toronto, 1944.

——. *Distribution and relationship in American hydroids*. Toronto, 1946.

FYFE, M. *A new fresh water hydroid from Otago (New Zealand)*. Trans. Proc. New Zealand Inst. **59** (4): 813–823. 1929.

GMELIN, J. F. *In* Linnaeus, *Systema naturae*, ed. 13, **1**(6): 3131. 1791.

JÄDERHOLM, E. *Mitteilungen über einige von der Schwedischen Antarctic-Expedition 1901–1903 eingesammelte Hydroiden*. Arch. Zool. Exp. et Gen. Notes et Revue, ser. 4, **3** (1): i–xiv. 1904.

LEIDY, J. [The Proceedings, Oct. 18, 1870.] Proc. Acad. Nat. Sci. Philadelphia **22:** 113. 1870.

MARTYN, T. *Universal conchologist* **1:** fig. 12. 1784.

PALLAS, P. S. *Reise durch verschiedene Provinzen des Russischen Reichs* **1**(5): 1–504, 24 pls. St. Petersburg, 1771.

ROCH, F. *Experimentelle Untersuchungen an* Cordylophora caspia *(Pallas) etc.* Zeitschr. Morph. und Ökol. Tiere. **2:** 350–426; 667–670. 1924.

SARS, M. *Beretning om en i Sommeren 1849 foretagen Zoologisk reise i Lofoten og Finmarken*. Nyt. Mag. Naturvid. Christiana **6:** 121–211. 1850.

SCHULZE, P. *Die Hydroiden der Umgebung Berlins mit besonderer Berücksichtigung der Binnenlandformen von* Cordylophora. Biol. Zentralbl. **41:** 211–237. 1921.

WARD, H. B., and WHIPPLE, G. C. *Fresh water biology*. New York, 1945.

ZOOLOGY.—*The diplopod family Campodesmidae (Polydesmida)*. RICHARD L. HOFFMAN, Clifton Forge, Va. (Communicated by E. A. Chapin.)

The name Campodesmidae was proposed in 1895 by O. F. Cook. Appearing in a key to the tropical African families of polydesmoid millipeds, the original description was rather inadequate. Subsequently, in several publications cited below, additional information (of a fragmentary nature) was given about the family and its two genera, but later workers have never been able to derive a very satisfactory idea of the nature of the group. It is a matter of some interest that campodesmids have never been encountered by other workers, who have managed to come across most of the other West African genera described by Cook.

Since the great majority of Cook's Liberian species have never been adequately described and have been mostly ignored by later workers, it appears necessary to redescribe them. Through the unfailing cooperation of Dr. E. A. Chapin, I have been able to study the Cook collection now in the U. S. National Museum. The present paper, the first of a planned series, is concerned with the campodesmids and with the systematic position of the family.

Family CAMPODESMIDAE Cook

Campodesmidae Cook, Proc. U. S. Nat. Mus. **18:** 82. 1895; Amer. Nat. **30:** 414. 1896.

Diagnosis.—Male gonopods large, prominent, protruding from a large oval sternal aperture. Coxae subcylindrical, attached loosely to each other, largely concealed within the aperture. Prefemur small, with a large unbranched laminate prefemoral process. No distinction between femur and tibiotarsus, the latter distally elongate, slender, forming nearly a complete circle.

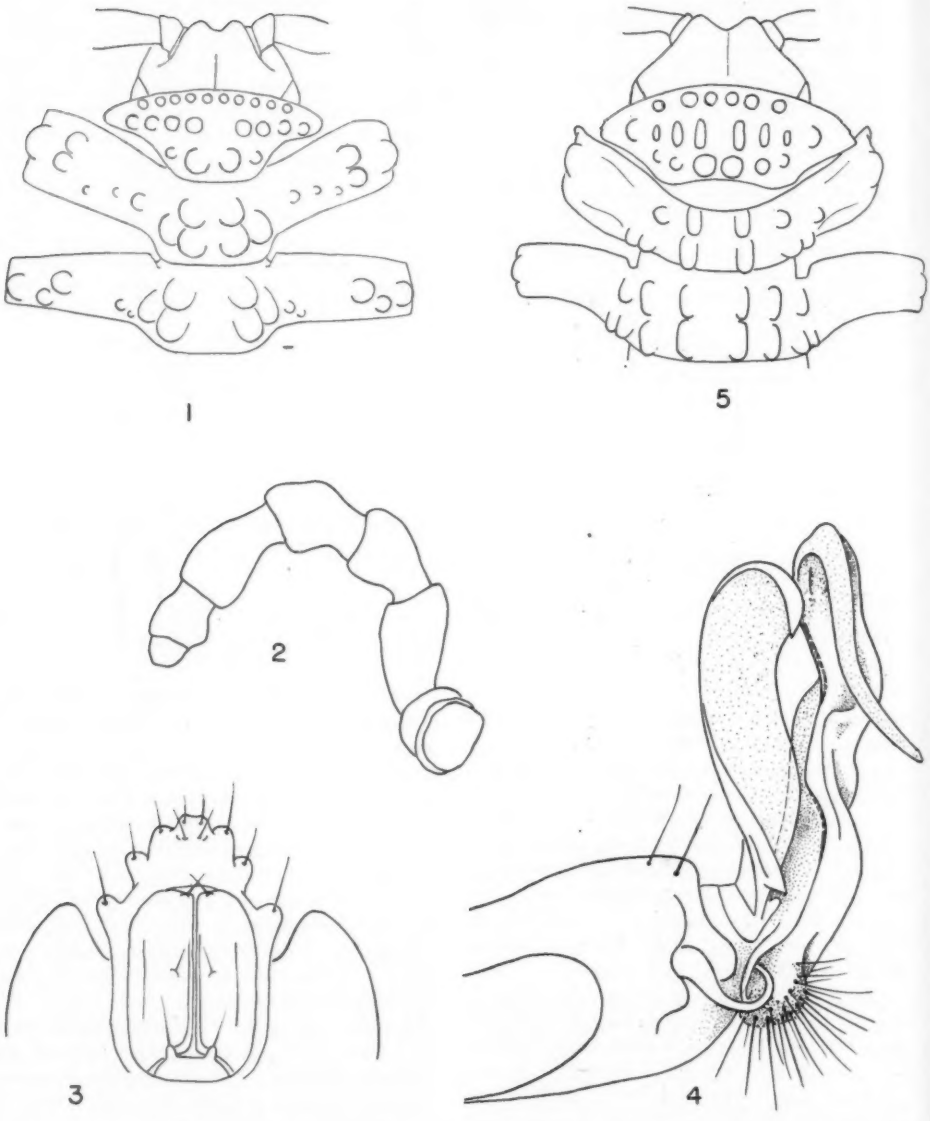
Gnathochilarium and mandibles typical of the usual polydesmoid form.

Antennae of moderate heaviness, with a few scattered hairs. Four sensory cones, concealed within the seventh article.

Head finely granular, with a well-defined vertigical groove. A prominent ovoid longitudinal swelling immediately under each antennal socket. Clypeal area much swollen, raised above level of frons, glabrous.

Collum rather small, not concealing the head and much exceeded in width by the keels of the second segment.

Keels of midbody segments well developed, wide as body cavity but narrow and widely



FIGS. 1–5.—1, *Campodesmus carbonarius*, dorsal view of head and first three segments; 2, same, antenna, much enlarged; 3, ventral view of last two segments; 4, left male gonopod, mesial aspect; 5, *Tropidesmus jugosus*, dorsal view of head and first three segments. Figures drawn to different scales.

separated from each other. Keels strongly depressed causing tergites to be highly arched.

Repugnatorial pores small, not on special stalks, occurring only on segments 5 and 7.

Anal segment large, not concealed by nineteenth, with three large tubercules on each side, distally bent slightly downward.

Preanal scale small, trapezoid, with two elongate setiferous tubercules. Anal valves nearly plane, each with a median tubercule.

Sternites rather broad and smooth, without special modifications.

Legs of moderate length and size, without spines, lobes, or tarsal pads.

Pleurites without carinae or large tubercules.

Range.—Known only from Liberia.

Genera included.—Two, which may be separated as follows:

1. Tergites each with a cluster of three elongate upright tubercules on each side of middle. *Campodesmus*

   Tergites each bearing two transverse rows, each of six short longitudinal carinae. *Tropidesmus*

Genus **Campodesmus** Cook

Campodesmus Cook, Proc. U. S. Nat. Mus. **18:** 82. 1895.

Generotype.—*C. carbonarius* Cook, by monotypy.

Diagnosis.—With the characters of the family, particularly distinguished by the ornamentation of the tergites. Collum with a row of 10 small tubercules on the anterior margin; a second row of eight larger tubercules across the middle. On the caudal half are two still larger tubercules with a small one laterad to each. Tergites of midbody segments with a cluster of three tubercules on each side of middle, these largest at midbody and diminishing towards the ends. Each keel bears three rounded tubercules near the outer end and two small ones at the base.

Campodesmus carbonarius Cook

Type specimen.—U. S. Nat. Mus., adult male, collected at Mount Coffee, western Liberia, by O. F. Cook.

Diagnosis.—With the characters of the genus. Dorsal color dark brown, underparts whitish. Length, from 28 to 38 mm.

Male gonopods of the form represented in Fig. 4.

Genus **Tropidesmus** Cook

Tropidesmus Cook, Amer. Nat. **30:** 414. 1896.

Generotype.—*T. jugosus* Cook, by monotypy.

Diagnosis.—Differing from *Campodesmus* chiefly in the nature of the ornamentation and in size and shape of the collum, as illustrated. Also, the second segment is not as wide and is somewhat more bent anteriorly. Collum with six tubercules along the front margin; eight in the second row (of which those at the ends are rounded, the others elongate); and six tubercules in the third row, of which the middle two are much enlarged. Second segment with keels produced forward, partially embracing and subtending the collum; dorsally with four short middorsal carinae and smaller indistinct tubercules laterad. On following segments the dorsal carinae increase to 12, in two transverse rows of six each. A single large swelling at the end of each keel.

Tropidesmus jugosus Cook

Type specimen.—U. S. Nat. Mus. (adult male?)[1] collected at Mount Coffee, Liberia, by O. F. Cook.

Diagnosis.—With the characters of the genus. Size and color about the same as in *Campodesmus*. The male gonopods may be expected to present additional specific and generic characters.

SYSTEMATIC POSITION OF THE CAMPODESMIDAE

The campodesmids seem not to be closely related to any other of the African polydesmoid millipeds. The family clearly falls into the group for which Brolemann in 1916 proposed the name "Leptodesmina." This ensemble is characterized by the fact that the coxae of the male gonopods are only slightly attached together, are not attached to the sternal aperture, and are generally concealed within the body when at rest.

In Attems' most recent key to the polydesmoid families (1937), *Campodesmus* runs down to the family Leptodesmidae (properly Chelodesmidae, *fide* Hoffman, 1950). The

[1] The original description mentions an adult male. The vial of material sent to me was labeled "Type" but contained only immature specimens. Presumably the mature specimen was taken out and is for the present misplaced in the body of the Museum collection.

configuration of the gonopod certainly vindicates this allocation, as the large prefemoral process occurs in nearly all of the South American chelodesmid genera. In other characters, however, no particular relationship can be observed. Rather some similarity is seen with the Platyrrhacidae, a family occurring in the East Indies and in Middle America but unrepresented in the Ethiopian region. The chief platyrrhacid features obtain in the broadened anal segment, subantennal swellings, and general appearance of the sternites.

The shape of the preanal scale and the dorsal sculpture are very reminiscent of certain genera (notably *Orodesmus*) of the Oxydesmidae, a small family occurring in Central and West Africa.

Considering the various developments of campodesmids which are duplicated in other families in different parts of the world, and the absence of any specialization such as pronounced sexual dimorphism, modification of the legs of males, etc., I am for the present inclined to regard the Campodesmidae as representative of a generalized ancestral chelodesmoid stock, a supposition not unsupported by the present areal distribution of the families concerned.

LITERATURE CITED

Attems, Carl Graf. *Fam. Strongylosomidae.* In Das Tierreich, Lief. **68:** 1–300. 1937.

Brolemann, Henri W. *Essai d'une classification des Polydesmiens.* Ann. Soc. Ent. France **84:** 523–608. 1916.

Cook, Orator F. *East African Diplopoda of the suborder Polydesmoidea, collected by Mr. William Astor Chanler.* Proc. U. S. Nat. Mus. **18:** 81–111. 1895.

———. *A new diplopod fauna in Liberia.* Amer. Nat. **30:** 413–420. 1896.

———. *Summary of new Liberian Polydesmoidea.* Proc. Acad. Nat. Sci. Philadelphia for 1896: 257–267.

Hoffman, Richard L. *The status of the milliped* Chelodesmus marxi *Cook, and of the family name Chelodesmidae.* Proc. Biol. Soc. Washington **63:** 185–188. 1950.

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